THURSDAY, AUGUST 13, 1874

ICELAND'S MILLENARY

ANNIVERSARIES are nearly as old as history, and are of constant occurrence; centenaries are of comparatively modern date, but have been not infrequent during the past thirty years; a millenary, however, must not only necessarily occur with extreme rarity, but there are many chances that in a thousand years an event which was long held of the greatest moment may be looked back upon with comparative indifference, may have dwindled into comparative insignificance, as seen from a new point of view or in the shadow of some more stupendous occurrence; or the individuality, whether a nation or a widespread association, in whose career the event was held to be of prime importance, may have become either extinct or absorbed in some wider individuality, which may not be so impressed by the memory of the episode as to be moved to celebrate its millenary. The Icelanders then have reason to congratulate themselves that they have kept their individuality intact for so long, as to be now celebrating the 1,000th anniversary of their origin as a distinct and separate community.

It will be found on examination that men keep alive the memory, by festival or otherwise, of any event because that event marks the beginning or the renewal of life in an individual or a community. There are many events in the history of individual nations and of the world which might thus very appropriately be annually or centennially remembered; there are not a few occurrences in the history of our own country that well deserve such a commemoration on account of the new impulses they gave to our national life and our intellectual progress, as well as indirectly to the advancement of the world at large. We believe that, on the whole, this periodical celebration of the occurrence of events which mark certain stages in the progress of a community or of the world serves a good purpose and ought to be encouraged; it affords us an opportunity to take stock of our gains, to measure the extent of our progress, to see wherein we have erred and how we ought to mend our ways; and last, but not least, it gives the world an excuse for learning something about the important events which have marked its history.

This celebration of the 1,000th anniversary of the colonisation of Iceland ought to excite the interest of a wider circle than the few thousands who fondly cling to the bleak but picturesque Arctic outpost which has been the home of themselves or their ancestors for a thousand years, and where they have maintained stereotyped, as it were, the physiognomy, dress, and manners of a people that were at one time rulers of the sea and very nearly lords of all Europe. It would be an interesting task to investigate the causes which have brought it to pass that a people at one time so overflowing with energy as the old Norsemen, should for some centuries now have been justly regarded as the most peaceable, industrious, and most home-keeping people in Europe. As everyone knows, for about 200 years from about the middle of the eighth century A.D. the Norse rovers, the "vikings," the men of the viks, voes, or bays, were to be found on almost every sea of Europe, rousing to activity or over-mastering the exhausted southern nations. It was no doubt good for our own land that it should receive such a large infusion of this energetic northern life, as it did, first in the shape of Danish invaders and settlers, who have left a broad mark on the northern counties of England, the south and north-east and west of Scotland, and again in the shape of the Normans who shed themselves over the land under the leadership of Duke William. These Norsemen, one of the branches of the great Teutonic kin, seem to have taken kindly enough to the wild, roaming life of sea-rovers, and hardy indeed they must have been to weather the hazards of the sea in such craft as they then could command. But, after all, it should be remembered that even in the eighth and ninth centuries Europe had not quite subsided from the commotions which followed on the coming in from the east of the great Teutonic wave, and as the Scandinavian offshoot was probably one of the latest to reach its destination, the great northern peninsula, we need not be surprised that it was one of the latest to settle down to a quiet and home-keeping life; it did so only after sending out wavelets in all directions, east and west and south, which wavelets produced impressions that have continued for good even until now. As seen in the stories, historical and legendary, that come down to us, these hardy Norsemen of yore were a glorious race of men, half barbaric as they were, full of the greatest capabilities and a splendid energy, to the infusion among us of which we ourselves are no doubt indebted to a considerable extent for the capacity which has enabled us to attain such large intellectual and material achievements, and for that never-subdued love of liberty which in all directions has been so fruitful in results.

Even in Iceland, cut almost entirely off as it has been since its colonisation from the influences that have stirred and moulded the rest of Europe, the fine energy of its Norse Colonisers has by no means died out. Yet this old Norse Colony cannot be said to have advanced much beyond the standpoint it occupied a thousand years ago. The Icelanders have no doubt produced much literature that must be of permanent value both intrinsically and as an all-important aid to the scientific student of language and of the human race. Still they must, we fear, be looked upon as a thousand years behind the rest of Europe, and a study of their present condition will afford an excellent means of estimating the immense advances which the civilised world as a whole has made during the last thousand years. And to what is this advance owing? Is it not simply that in Europe generally, knowledge has been spreading in an increasing ratio, and that our knowledge has been becoming more and more scientific? Would not a survey of the nations of the world show us that those nations in which science is cultivated to the highest possible extent alongside of other fields of intellectual activity, are the nations which hold the front rank in the march of the world's progress? In short, it will be found, we believe, that the world's progress and science are almost convertible terms. But science to be of any practical utility requires something to work with, and that something in the case of our own nation is Coal. The student of history ought to bear this in mind, and thus he will see that in Iceland, however far theory might have

gone, geology would for ever have forbidden any great national advances as depending on science. Here is a tremendous thought for our statesmen and political economists. England without science would have been in the position of Iceland without coal!

The early visitors to Iceland are said to have found traces of former visitors in the shape of books, crosses, bells, &c., which it is supposed may have been left by monkish voyagers or fishers from Ireland, which at that time was pre-eminent in Europe for its learning. And this learning was the secret and the reason of Ireland's early pre-eminence; and it is only by the spread of education and by bringing the people under the influences which have done so much for the rest of Europe, that she can ever regain the position she once so proudly occupied. The Icelanders, on the other hand, seem to have improved as far as their opportunities have allowed them; but these opportunities have been comparatively few and unimportant. Now, however, that Denmark is handsomely to grant the island a reformed constitution, and that the eyes of the civilised world at large have been attracted to it, we hope Icelanders will be led to develop, by means of education and scientific knowledge, their own latent capacities as well as the capacities of their island home, which, like themselves, seems as if it were the "fragment of a former world." It is almost too trite to say that it is wonderful what human energy will accomplish under the most adverse circumstances when directed by scientific knowledge and stimulated by the encouragement and the hope of the approval of our fellows. And if the Icelanders generally had among them the opportunities of bringing themselves abreast of the rest of the world as far as education is concerned, and especially in respect to a knowledge of the methods and results of science, if even a very few of the permanent inhabitants became competent observers of nature, might we not rationally look for results that would shed considerable light on various important points in science—in geology, for example, and meteorology—that are waiting to be cleared up? Iceland, indeed, might very well become the world's polar observatory. Let us hope that this new episode in the history of Iceland may be productive of widespread and lasting benefit to the people themselves, and lead to an increase of the general sum of intellectual progress; and all peoples who can in any way claim to a Norse connection ought to sympathise with their old-fashioned brethren in their rejoicings, and lend them a helping hand to enable them to partake of the many good results which Norse energy has helped to achieve. Their quaint old Sagas, we are sure, would not give less pleasure during the dreary nights of their long winter, if told to an audience whose resources of rational enjoyment have been increased by a knowledge of "the fairy tales of science, and the long results of time."

The Icelanders themselves have good reason to remember the period of the colonisation of their wild island, for it was carefully planned and judiciously carried out a thousand years ago, and obtained effectually for its originators that freedom which they were in great danger of losing under the tyranny which then oppressed their native Norway. And here we may state, as a curious fact, that the millenary festival of the establishment of the kingdom of Norway itself took place only two years ago. That, and the festival of which we speak, are, so far as we know, the only celebrations of the kind that have hitherto been kept.

It was about the year 861 A.D. that Iceland was first seen by the Norsemen; the story being that in that year one Naddod, a vikingr, a leader of one of the then frequent plundering expeditions, was driven by a tempest on the eastern coast of this then unknown country, to which he very naturally gave the name of "Snjóland." No doubt Naddod would tell the story of his accidental discovery to his own folk when he returned home from his roving expedition, and it was possibly this story that instigated Gardar, the Swede, whose home was in Denmark, to visit the new-found land.* This Gardar seems to have found a good harbour near the present Austerhorn, where he wintered, and in the following year completed the circumnavigation of the island, which he renamed after himself "Gardarsholm." The next visitor to the yet uninhabited island is said to have been a "mickle" Norwegian vikingr, Floki "Volgertharson," who struck the east coast a few years after Gardar, and sailing south and west landed at Vatna Fjord in Bardestrand. Floki explored the country to some extent, and would have settled therein with his followers had not their cattle all died. He, however, appears to have passed a second winter at Hafna Fjord, returning home in spring full of information concerning the new land, which, the chronicles say, was at that time covered with wood, and otherwise more inviting than it is at the present day. Indeed, one of Floki's companions is said to have given quite a glowing account of the country; the very grass, he said, "dropped butter." From the large quantities of drift-ice which he found in the northern bays, Floki gave the island the name by which it has been ever since known—Iceland.

By this time the overbearing conduct of the Norwegian king, Harold Haarfager, had so galled his high-spirited nobles that to many their country had become intolerable, and they were quite ready to welcome any chance of escape from their monarch's oppressions. Love and murder, however, seem to have been the immediate causes of the first deliberate emigration from Norway of a band of colonists for Iceland. Ingolf and Leif, the story goes—and we believe its main features may be relied on as authentic—were two cousins, whose fathers had been obliged to fly from their native province for murder. Ingolf had a beautiful sister, Helga, whom Leif loved, but she was also loved by Holmstein, one of three sons of a powerful Norwegian noble, who were companions of Ingolf and Leif in their piratical excursions. Leif married Helga, and had therefore to meet Holmstein in mortal combat, when the latter was done to death. This and other occurrences made Norway too hot to hold the two cousins, who, indeed, had been condemned to banishment. After two piratical trips to Ireland, from which they returned with great booty, the cousins with their families and friends and Irish slaves, their goods and their chattels, bade farewell to their native land in the year 874 to found a republican colony in Iceland. Ingolf was first forced to land on a promontory on the south-east coast, which was hence named Ingolfshöfde, where he

* But according to the table in Rafn's "Antiquitates Americanæ," it was Gardar who discovered Iceland in 860.

remained three years, at the end of which time he removed to the site of the present capital, Reikjavik ("Reeky Bay"), where superstition apparently determined him to remain, notwithstanding the remonstrances of his servants, who had seen many more inviting spots along the coast. Meantime Leif, or Thorleif as he was now called, from a big sword he brought back with him from Ireland, had built his house at Thorleifshöfde, where, in the first spring after his arrival, he began to cultivate the ground. Having only one ox, however, the story goes, he compelled his Irish slaves to draw the plough; they thereon rebelled and murdered their master, they themselves being in turn pursued and nearly all killed by Ingolf, who then appropriated all the country between the river Olousa and Hval Fjord. The oppressions of Harold the Fair-haired soon sent many of the best of Norway's sons to become settlers in the new colony, and thus it was that Iceland was peopled, not by the scum of the mother country, as is too often the case, but by the best blood of old Norway. This influx of colonists continued for sixty years, when, the causes of emigration from Norway having ceased, and the best ground in Iceland having been fully occupied, immigration gradually came to an end.

From the first the colonists seem to have set themselves to make the best of their not very promising surroundings, and ere long to have settled down into a comparatively peaceful and contented community. One Ulfleet is said to have compiled a code of laws, and instituted the "Althing," or National Assembly, in 928, when for the first time it met at Thingvalla. Among other enactments pauperism was suppressed as a crime by the severest laws, one of which was intended effectually to prevent the procreation of a pauper class in a country where it was only by dint of the hardest labour that the sea and the land could be made to yield enough for all. The colonists were converted to Christianity about the year 1,000; in 1261, after many internal contests, the whole island swore allegiance to the Norwegian king, but about 1387 it was transferred to Denmark, attached to which kingdom it has ever since remained. The King of Denmark is now on the island —an event of the rarest occurrence—and, as we have said, is to grant to his Icelandic subjects a new and liberal constitution; we believe he is accompanied by Prof. Steenstrup.

This, deprived of detail and of much that is doubtful —though the Icelanders have less of the legendary in their early history than most other old countries—is the story of the colonisation of Iceland a thousand years ago. We have not space to enter into further detail concerning the physical aspect of the island, the character and customs of the people, their wonderful literature in all departments of intellectual activity, their discovery of and long intercourse with Greenland and North America. Greenland was seen by an Icelander, Gunnbjorn, so early as 877, and for centuries after some rocks between Iceland and Greenland were known as "Gunnbjorn's Skerries." Erik Rauda ("the Red") first visited Greenland in 983; three years afterwards he planted a colony on the south-west coast. We understand that a deputation from America is attending the millenary fêtes now being held in Iceland, and that some of the American scientific societies have shown their good-will by sending valuable presents of books, &c. This is right and becoming on the part of the Americans, for, as we have just indicated, the Icelanders were the first European colonists of America, and had regular intercourse with the western continent for about 300 years; and it is curious to conjecture what might have been the history of that continent had the Norse attempts at colonisation not proved abortive. It is by no means improbable that Columbus himself, when he made that northern voyage in 1467, "a hundred leagues beyond Thule," may have heard some fragmentary traditions of the Greenland colony which he may have treasured in his heart as a confirmation of the idea which was subsequently to bear so rich fruit.

The history of this old Norse colony proves that the people have great capacity for work, and we again hope that this celebration of the courage and dauntless energy of their forefathers will be the means of rousing them to renewed activity, which will be beneficial both to themselves and to the world at large, which has increasing need of all the really good working power it can command.

RECENT RESEARCHES IN PHOTOGRAPHY

A SUBSTANTIAL contribution has been recently made to our knowledge of the action of light upon silver salts—a contribution which we cannot but consider as of the highest importance to photography, both as a science and as an art.

In the autumn of last year Dr. Herman Vogel announced * as the result of some experiments that he had been making, that "we are in a position to *render bromide of silver sensitive for any colour we choose*—that is to say, to heighten for particular colours the sensibility it was originally endowed with." This discovery is such a decided advance that it will be interesting to trace it from the beginning. Dr. Vogel, in the first instance, found to his astonishment that some dry bromide plates prepared by Col. Stuart Wortley in this country were more sensitive to the green than to the blue portions of the spectrum. This result was so totally opposed to the generally received notions that the subject was submitted to further examination. In the next experiments a comparison was instituted between dry bromide plates and the same plates when wet from the bath solution of silver nitrate. The results showed a decided difference in the behaviour of the plates. The sensibility of dry bromide plates appears to extend to a greater extent into the least refrangible end of the spectrum than is the case with *wet* plates. In Dr. Vogel's plates, in fact, which received the spectrum formed by the battery of prisms of a direct vision spectroscope from a ray of sunlight reflected from a heliostat and passing through a slit 0·25 mm. wide, the photographic impression of the spectrum, when developed by an *acid* developer, extended in the case of the dry plates into the orange, but with wet plates not quite into the yellow. The bromide plates prepared by Vogel, moreover, did not exhibit that increased sensitiveness for the green rays which characterised Col. Stuart Wortley's plates, and this led the German investigator to conjecture that the latter plates contained some substance which absorbed the green to a greater extent than the blue. To test this

* *Poggendorff's Annalen*, vol. cl., p. 453.

conclusion one of the plates was washed in alcohol and water in order to remove the yellow colouring matter with which the plate was coated, and it was then found to have lost, in accordance with Dr. Vogel's anticipations, its sensitiveness for the green rays. The peculiar action of the Wortley dry plates was thus shown to be due to the coating of colouring matter, and the next step made by Vogel was to seek some substance which especially absorbed in the yellow, and at the same time acted as a sensitiser by fixing the free bromine liberated by the action of light upon the silver bromide. Both these ends are fulfilled by the coal-tar colour known as *coralline*. A plate dyed with this substance and exposed to the spectrum exhibited two maxima of photographic action, one the ordinary maximum in the indigo (near G), and the other, almost as strong, in the yellow, thus affording complete confirmation of Dr. Vogel's views. Aniline green* was next tried. This dye is stated to absorb the red rays, and a corresponding increase of sensitiveness for the red rays was observed, the photograph again presenting two maxima of activity, the one in indigo and one in the red coinciding in position with the absorption band of the dye. Thus Dr. Vogel's results may be summarised by saying that a dyed film of silver bromide exhibits maxima of sensitiveness in those regions where the colouring matter exerts its maximum of absorptive power, but the precise conditions under which these results can be obtained must be considered at present as unknown, since many observers in repeating the experiments, among others Dr. Van Monckhoven,† have failed to obtain other than negative results.

In a communication made to the French Academy on the 27th of last month, however, the well-known physicist, M. Edm. Becquerel, stated that some experiments made at his instigation by M. Deshaies at the Conservatoire des Arts et Métiers had been productive of positive effects, and that some of Dr. Vogel's results with coralline and aniline green had been reproduced. M. Becquerel, however, does not confine himself to bromide films; similar results have been obtained by iodised collodion in which coralline was dissolved. A most remarkable action was observed also in the case of chlorophyll when this substance was used as a tinctorial agent. Although the collodion possessed only a faint green colour from the dissolved chlorophyll, the spectral image was of a much greater length than when plain collodion was used. Under these last circumstances the spectrum extended from the ultra-violet to between G and F, with the usual maximum of action near G, while with chlorophyll the region of strongest action extended from the ultra-violet to the line E in the green, and at the same time a weaker but yet distinct impression extended from E to beyond B in the red, with a strong band between C and D. By a close examination of the spectral image a second band of less intensity could be detected on the least refrangible side of the band between C and D, and other still weaker bands appeared in the green. The most striking confirmation of Vogel's results is to be found in the fact, observed by M. Becquerel, that the band between C and D *corresponds in position with the characteristic band of the absorption spectrum of chlorophyll dissolved in collodion.*

* The green referred to is probably that known as "aldehyde green." The so-called "iodine green," as I have frequently observed, *transmits* a band in the red

† *Photographic Journal*, No. 25, June 20, 1874.

The same results were obtained by M. Becquerel with every plate tried and with collodions containing different quantities of chlorophyll.

It must be admitted, then, that a film exerting selective absorption in intimate contact with a sensitive film of silver bromide or iodide affects the latter in those parts of the spectrum where the selective action is taking place. Here surely is a wide field for investigation, and one the importance of which will be at once obvious to the physicist. Practically also, when the precise conditions of action are made known, valuable results may be anticipated from the application of this principle to science and to art. Since the year 1842, when M. Becquerel photographed the whole solar spectrum from the extreme violet to the extreme red, and when Dr. J. W. Draper photographed the violet, blue, and extreme red, no successful attempts have been made to imprint the least refrangible end of the spectrum; and this, when we consider the great importance that the study of the solar spectrum has assumed of late years and the painful or even dangerous character of prolonged eye observation, is to us a matter of wonder. M. Becquerel's result, it will be remembered, was obtained by a film of silver iodide, first insolated or exposed to diffused light and then to the action of the spectrum. Here again is another question—the precise action of *insolation* on sensitive plates—demanding explanation at the hands of the physicist. The practical aspect of Dr. Vogel's discovery need not here be discussed at length. Attention may be called to the well-known difficulty of getting reds or yellows to imprint themselves in portraiture, a difficulty which now bids fair to be overcome.

Then again, in what we must consider as a higher sphere of practical utility, great advantage to the study of solar physics is likely to accrue. In point of fact the photographic method of comparing spectra described in a recent communication to the Royal Society now becomes available for the whole extent of the solar spectrum, and our knowledge of the true composition of the sun will be thus in course of time recorded permanently on "that retina which never forgets."

Great results have already been achieved by photography, and greater may be looked for. It must not be forgotten that in this most interesting branch of chemical physics we are in a period either of provisional hypothesis, or, worse still, of no hypothesis at all, so that valuable additions to our knowledge of physical and chemical laws should be forthcoming. The changes wrought by a beam of light on sensitive surfaces are sometimes physical and sometimes chemical. We may appropriately recall here the fact that mechanical pressure upon a sensitised surface of a silver salt acts in the same manner as a ray of light, giving a dark stain under the action of reducing agents. The experiment of Grove also, in which an electric current is set up by the incidence of a beam of light upon a prepared Daguerreotype plate, should not be forgotten. The equivalence between light and the other form of force has not yet been established, and it may not be going too far to conjecture that thermodynamics may possibly in the future have to appeal to the action of light upon a photographic plate. In the meantime we look forward to the promised continuation of Dr. Vogel's researches with no little hope.

R. MELDOLA

LADY BARKER'S "LESSONS ON COOKING"

First Lessons in the Principles of Cooking. By Lady Barker (London: Macmillan and Co., 1874).

IN this little volume the authoress has proved beyond all manner of doubt how completely she is the right woman in the right place. Surely nowhere could the Committee for the National Training School for Cooking have found a lady superintendent better fitted than Lady Barker to put life and spirit into the scheme which they advocate, or one more thoroughly qualified to train and marshal the feminine bands that are now being drilled under her supervision in the South Kensington Schools of Cookery to invade and revolutionise the kitchens of the future in every part of the empire.

In the introductory chapter of her "First Lessons in the Principles of Cooking" the author at once grapples with the chief difficulty of the question at issue, and admitting the fact that fuel and food cost nearly twice as much as they did ten years ago, she tells her readers that this is precisely the reason why it has become the imperative duty of every mistress of a house, and indeed of every member of the community, to learn how materials for warmth or cooking may be made to go twice as far as they have done hitherto. And it is this problem which she here attempts to solve by help of her own practical experience, which was gained in that best of all training-schools, the school of necessity, as it existed in earlier days in the colony in which she learnt her first lessons of cooking. The theoretical knowledge of the "why" and the "how" has, as she informs us, been a far more recent acquisition in her case; but it is evident from the manner in which she discourses on the chemical composition of different articles of food, their various assimilative and other properties, and the confidence with which she tests, by the laws of science, every function of her ovens, pans and kettles, that she has mastered the scientifically theoretical branches of culinary knowledge as successfully as, in bygone times, she overcame its empirically practical difficulties.

Her lessons on baking, roasting and frying, boiling and stewing, and her remarks on fuel and fire, and on the advantages, economical and others, of cleanliness, are so sensible that we may commend them to the careful study of all housekeepers, young and old, who are actuated by the laudable ambition of combining economy and comfort downstairs, with good digestion and its concomitant, good humour, upstairs. When we say that Lady Barker is actually aiming at the daring innovation of making thermometers and "friometers" as indispensable to the cook as the compass is to the helmsman, we need expatiate no further on the debt of gratitude due to her from all long-suffering payers of heavy coal and meat bills. It might be supposed that Lady Barker's book was intended solely for her own sex, but this is not the case; for, more widely expansive in her desires than Mr. Ruskin, who wishes to see "every girl taught at a proper age to cook all food exquisitely," she considers that "a knowledge of cooking is every whit as necessary for a man," although she would not insist, in his case, on anything beyond the simplest forms of the art; and she evidently hopes to see the day when boys and girls will compete together for prizes in the National Cooking Schools. More practically important and worthy of serious consideration is the strongly expressed conviction that "no schoolboy ever gets as much nourishing food as he requires, and that this is the secret why boys of fourteen or fifteen years old scarcely ever look anything but thin and pinched." Furthermore, she wishes their parents and schoolmasters to understand that if they desire to see boys with clear complexions, bright eyes, and active limbs, "every game of football and cricket and every sharp run across country on a paperchase ought to be followed by a hearty meal of good beef or mutton, and not merely by weak tea, poor milk, and bread and butter."

The author's experience of the enormous amount of meat—uncontaminated by stimulants, it must be remembered—which growing boys and young men consumed in New Zealand in the early times of the colony, has also led her to form the opinion that, in spite of all tables and dietary reports, our soldiers and sailors are not allowed food enough for healthy men with good appetites. This, however, is a point that we must leave her to settle with her Majesty's Inspectors of military and naval affairs, to whose notice we would strongly commend her book, as well as to that of all other persons interested in the practical and economical bearing of the relations existing between the consumption of food and of fuel, and the hygienic condition of the consumers. It is quite certain, however, that until the general masses—and consequently all those who have hitherto monopolised the direction and practice of cookery—shall become better acquainted with the ordinary laws of physiology and chemistry, it will be hopeless to look for any radical improvement in the manner of using food and fuel to the best advantage in our households. Hitherto our kitchens have been managed haphazard, without system; the time for allowing such a wasteful condition of things to continue undisturbed is evidently drawing to a close. High prices and diminished supplies require to be met by a new system, based on true scientific principles; and considered from this point of view, we think that this little volume may fairly claim to be considered as supplying the thin end of the wedge, and indicating the manner in which the questions of practical cookery will in future have to be considered.

MAUNDER'S "TREASURY OF NATURAL HISTORY"

The Treasury of Natural History. By Samuel Maunder. Edited by E. W. H. Holdsworth, F.L.S., F.Z.S. (London: Longmans, Green, and Co., 1874).

THERE are few tasks more thankless and disagreeable than that of having to re-edit an encyclopædia or a dictionary, especially when it relates to a subject like Zoology, which is still so much in its infancy. A "Treasury of Biography," or a "Treasury of Bible Knowledge," in each fresh edition cannot, from the nature of its contents, need much modification; the manner in which the points that are dealt with have become stereotyped on the minds of mankind at large, makes the same operation having been performed on the letterpress a comparatively unimportant drawback to its reappearance in a

form which will not be considered antiquated. This is far from the case in a work like the one we are now noticing. The spirit of biological thought changes as rapidly as fresh facts accumulate. The introduction of an all-embracing hypothesis, like that of evolution, shakes previously accepted theories to the foundation; long-known facts are looked at in quite a different aspect to that in which they were received before its introduction, and their relative value is differently estimated.

How then can it be expected that a zoological work, originally written when Cuvier's celebrated "Regne Animal" was the latest text-book on the subject, could be so modified by an editor, however able, as to make it at all a representative of the present state of biological knowledge? To do so the article on the "*Pachydermata*, an order of Mammiferous quadrupeds distinguished by the thickness of their skins," would have to be removed; that on each of its component genera re-written, and the word itself obliterated from the whole work. A similar operation would have to be performed on many of the larger orders; and to such an extent would this process have to be carried on, that it would soon become doubtful whether a new work instead of a fresh edition would not be the more economical as well as the more useful.

This being the case, we are not surprised when we find that nothing more is said of the affinities of the Echidna than that "it has the external coating and general appearance of the porcupine, with the mouth and peculiar generic characters of the ant-eaters;" whilst the word "monotreme" is only mentioned in the second supplement. In like manner we notice that the Dugong and Manatee are said to rank among the Cetacea; whilst the Sirenia are omitted except in the appendix. The word "Chevrotain" refers us to "Musk Deer," thus perpetuating the well-known error; and, on finding it, we are told that there is a Javanese Musk deer (*Moschus javanicus*) rather larger than a full-sized hare, at the same time that "there are other musk deer, which are very small, and to which the general term of *Chevrotains* is given; they are inhabitants of Java, Sumatra, Ceylon, and Southern India." The genus "Ammocetes" has not been removed, and is still said to be "a genus of Chondropterygious fishes, allied to the lampreys," instead of the young of the lamprey, which it has for some time been known to be.

The creatures most fully treated of are the birds, the best known of which are described with fair completeness, with extracts from the works of Mr. Gould and other observant naturalists, as to their habits and coloration. We do not know why the Poe Honey-eater (*Prosthemadera concinnata*) is described both under its English and Latin name, in the same way that it is difficult to account for the Orycteropus and the lady-bird being each represented twice by woodcuts.

Several of the original articles are lacking in important detail. Of the Ammonite and Orthoceras it is only said that they are genera of fossil shells, which leaves their affinities unnecessarily vague. So there is not much to be learnt from the observation that Nummulites are "small round fossil shells, which in various parts of the world are found in immense numbers."

Mr. Holdsworth adds an extra supplement, which contains much useful information of recent origin. It includes an account of the breeding of the hippopotamus and of the Sumatran rhinoceros, specimens of both of which have been born in this country during the last two or three years. The Liberian, or Lesser Hippopotamus, is also described, as is the new Bird of Paradise *Drepanornis d'albertisi*, obtained from New Guinea by Signor d'Albertis, and named by Mr. Sclater. An account is also given of the nesting of the crocodile in Ceylon, and of the incubation of the python.

This second supplement also adds to the palæontological information contained in the first, by giving a description of the *Dinoceras mirabilis* of Prof. Marsh, from Colorado; of *Archæopteryx lithographica*, of the other Odontornithes, and of *Odontopteryx talipoica*.

Notwithstanding the imperfections we have pointed out, there is much information to be obtained from this work, and which can be obtained from it more easily than from any other, on account of its being arranged alphabetically, and from the succinctness of the articles.

OUR BOOK SHELF

The Amateur's Photographic Guide Book. Being a complete *Résumé* of the most useful Dry and Wet Collodion Processes, especially for the use of Amateurs. By W. J. Stillman. (London: C. D. Smith and Co.)

ALTHOUGH we already possess numerous books of this class, the present little volume will doubtless meet with a welcome from amateur photographers, coming as it does from the pen of one well known to be a thoroughly practical worker. The book is small (numbering only 92 pp.), but contains sufficient information for those who desire to master the dry and wet collodion processes. Indeed, more pretentious works on photography which have come under our notice contain a large amount of what we are inclined to regard as utterly superfluous matter, and it is, moreover, refreshing to open a "Guide" which is not made a medium for some dealer's price-catalogue. The present work consists of three chapters and six appendices. The first chapter treats of cameras, and describes the process of taking pictures by the dry-plate method; some useful hints will be found in this chapter by outdoor photographers. The second chapter describes the ordinary wet collodion process—a process which has been so often described before, that Mr. Stillman has little to add by way of novelty; while the third chapter is devoted to positive prints. In the appendices we have special remarks on baths and bath solutions, on cleaning plates, on developers, on dry processes, &c. On this last subject, by the way, we notice that the decimal point has been omitted from several of the numbers in the formulæ, and although these are doubtless typographical errors, the figures as they stand will be apt to mislead beginners: "Sulphuric acid 1840," for instance, would at first sight lead the uninitiated into the belief that an acid in bottle since this date was necessary for success in making pyroxyline, whereas the author only means an acid of sp. gr. 1·840.

On consulting books on practical photography, anyone who pretends to any knowledge of chemical science cannot fail to be struck by the empiricism of the various formulæ proposed, and a feeling akin to regret is experienced on reflecting that this fascinating and useful art has reached its present state of perfection by processes which have been essentially methods of trial and error. The large numbers of practitioners, both professional and amateur, now engaged with this subject ought surely to produce from their ranks investigators willing, as we know they are able, to take up the purely scientific aspect of the subject. The harvest reaped by such an investigator would surely repay him, for we are of opinion that in the theory of the sensitive film lie hid some of the fundamental truths of molecular physics. R. M.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. No notice is taken of anonymous communications.*]

The Woolwich Aëronautical Experiment

I HAVE read, not without some surprise, the accounts given by the daily papers, stating that the recent experiment at Woolwich had been fruitless. The lessons of the experiment are numerous, although it would have been easy to predict all that happened; but the impressions relating to balloons and ballooning are generally so vague and so incorrect, that I may be justified in trying to summarise the results which were obtained in connection with the siege of Paris, which might otherwise be lost altogether.

As I stated in my article on the "Flying Man" (vol. x. p. 230), the principal object to be considered in the theory of aërial motion is the friction of the moving surface against the air; the friction increasing according to the square of the rate of motion v^2, the force necessary to move the body at a certain rate varies according to v^3. Consequently it is easy to impart a small motion to a balloon; but the difficulty very quickly becomes insuperable except with an almost inexhaustible source of power, such as a powerful steam-engine. *Hand-power cannot be made of any avail;* M. Dupuy de Lome's experiments proved this definitively, and that question must be considered as settled in favour of *steam-power*.

The problem now at issue is to ascertain whether it is possible to construct a *safe* fire-engine balloon, and to use it successfully for travelling to a distance. But I shall give some calculations on the recent experiments with hand power.

If we suppose that the motion of the directing balloon is uniform, the friction consumes all the force which is generated;* consequently, if n = number of men pulling the fan, m = the real motive power generated by each man, k = a coefficient which depends on the nature of the surface of the balloon, l = great axis of balloon, r = radius of equatorial section, v = rate of motion—I suppose that r was the same for Dupuy de Lome as for Bowdler, and that M. Dupuy de Lome's great axis was $2r$, his number of men twelve instead of two, and his rate of motion 9 ft. per second—we shall try to find what ought to be the motion of Bowdler's balloon.

As according to the principles of mechanics

$$v = \sqrt[3]{\frac{n.m.l}{k r^2}}$$

it is easy to find

$$v^1 = \frac{3}{\sqrt[3]{6} \times 2}$$

under these circumstances. But m is not the same, as Dupuy de Lome's men were pulling on a large screw acting without any transmission; Bowdler's apparatus was a small screw 3 ft. in diameter. I suppose Bowdler's utilisation was only half of Dupuy de Lome's; consequently the real equation is

$$\frac{v^1}{v} = \frac{1}{\sqrt[3]{6 \times 4}} = \frac{1}{\sqrt[3]{24}}$$

not far from $\frac{1}{3}$. The motion of Bowdler's balloon could not be more than 3 ft. a second.

It was impossible for Major Beaumont to see any difference with the motion of the air being at a distance from the earth. It could be ascertained with very great difficulty even with an aëronautical compass of the best description.

But the fact of the balloon having been put into a state of rotation by the rudder is a demonstration of the fact of a differential motion having been obtained. It is the very pressure resulting from the differential motion which is the only force that rotates the balloon in acting on the rudder. The rudder is pushed as it is in the sea when the ship is acted on by sails or steam, and in the air the action is very easy, as the balloon is almost symmetrical around its vertical axis.

It is true the governing power could be imparted very easily by direct action on an excentric helix adjusted for the purpose, as has been suggested, but not tried, so far as my knowledge goes. I will say the same of the vertical motion, which is very important also for ballooning; but the theory being a little more complex, I shall keep it in reserve for a future communication.

The rotatory power is of importance in making observations in the air, and it is praiseworthy in Major Beaumont and Mr. Bowdler to have directed their attention to that particular point.

The abstract principles of aëronautics have been pretty well ascertained, but the practice is a very difficult thing, and can only be tested by a series of experiments. With such an experienced balloonist as Mr. Coxwell, and the resources of an enlightened Government like that of England, it seems likely that such experiments will be tried more easily than in France. Under the present circumstances, I think it is our duty to assist you so that you may derive benefit from the knowledge we bought so dearly amidst our great national calamities.

W. DE FONVIELLE

* I speak only of the motion in still air.

Fogs, Field-ice, and Icebergs in the Atlantic

THREE unwelcome phenomena have this year, in more than an ordinary degree, vexed the coasts of the United States and the navigation of the Atlantic; I allude to fogs, field-ice, and icebergs. The first have so much interfered with the success of the Nantucket fishermen that but few mackerel have been caught by the seine, the schools cannot be followed, and the boats have frequently remained idle for days. No one who has not met with these fogs can form an idea of their density. With a bright sun shining over head, objects cannot be discerned at the distance of 100 ft Collisions have been numerous in all the great American ports and rivers. On one occasion hundreds of tons of cargo remained two days in New York before it could be transported across the Hudson to Jersey city, although the distance was frequently under a mile from wharf to wharf.

At sea these fogs have extended almost without a break for 1,600 miles, the wind being from east, through south, to west. When sounding the steam whistle I noticed, what has probably been noted before, that the denser the fog the greater were the reverberations, and that the echo was always heard to windward as plainly as if it were deflected from a cliff in that direction. I presume that this arose from the resistance the waves of sound encountered in travelling against the wind, none being heard to leeward. These fogs are attributed to the great difference which exists in spring and summer between the temperatures of the air and water. Having, however, often remarked that they come when these conditions are not found, I am induced to believe the cause must often be looked for in the atmosphere alone, by the mixture and condensation of the different strata of air there. At times these fogs are in streaks, and the alternations of heat and cold, as they sweep by, are very noticeable. Now, if the sole cause were due to a simple difference of temperature between the air and water, I cannot understand why this should be, unless the sea was composed of similar streaks of hot and cold water, which here is not the case.

In the Atlantic, seamen were astonished to find that early in February field-ice and bergs had reached the parallel of Cape Race, and have since been seen as far south as 42° N. lat., drifting to the north-east in the heated waters of the Gulf Stream. Two steamers and an equal number of sailing vessels are known to have been seriously damaged by colliding with them; and the wonder is that so few accidents have taken place when it is borne in mind that for hundreds of square miles the steam and sailing tracks between America and this country are dotted with them. A few of the bergs have been supposed to be three miles in length, and on two occasions steamers passed through or around ice-fields 100 miles in length. It is also alleged that another was stopped five hours by field-ice so far south as the forty-third parallel.

There is a general belief that the vicinity of ice may be readily detected by the fall in the temperature of the water. Unless it be in very large masses, and the ship close to, this test is not of much value, owing to the natural law which causes a cold surface fluid to sink until equilibrium is restored. A better test is the cold, damp feeling of the air, but this is only noticeable when to leeward of the berg or field, and is practically of no value, as the wind passing over the sea-water at 28° will cause a similar sensation. In some states of the atmosphere the clouds near the horizon assume a peculiar grey tint when the ice-field is of large dimensions.

Unless the weather be very foggy, an iceberg is easily distinguished on the darkest night at a considerable distance by the light reflected from it, and to this cause I attribute the great immunity of ships from accidents. Ordinary islets dropped in the Atlantic would cause an infinity of wrecks, owing to the absence of this useful property. When an iceberg reaches a low latitude it loses much of its beauty; the brilliant white and pris-

matic colours which it had in the north disappear, and the whole mass, except under peculiar circumstances, looks like a mountain of soda. At rare intervals, however, during a gorgeous sunset, the tinted clouds are reflected on its sides, and their various colours flash across like the shades of a rich shot silk, but infinitely more beautiful, eliciting terms of admiration alike from the sentimental dandy or the rough emigrant.

The cause of their early appearance so far south this spring is a mystery; many attribute it to a mild season. As I have before stated, I cannot concur in this opinion. No man can with certainty assert that in the Arctic regions a January temperature can cause the fracture of such masses from their original beds.

Celtic, July 28 WM. W. KIDDLE

Science at Cambridge

IN an article on the Public Schools Commission published in NATURE (vol. x. p. 219), the following passage occurs:—"Now it is acknowledged on all hands that the teaching of a subject at school and its recognition at the universities are inseparably connected, and especially with regard to science. The Colleges say, We cannot give more scholarships, because a sufficient number of men of good attainments do not present themselves; and the Schools reply, We cannot spend our time on subjects for which there are so few rewards. Both profess willingness, but each calls on the other to take the initiative." It is implied by this that the schools and universities each shelter themselves in their conservatism by throwing the blame on the other. With respect to the University of Cambridge, at least, I think this is unfair. King's College offered scholarships (of 80*l.* a year for three years) for natural or physical science in the years 1872 and 1873; on both occasions the examiners (who were in no way connected with the college) reported that no candidates of sufficient merit had presented themselves. At length, in the present year, they have awarded a scholarship in these subjects.

Everyone who is conversant with Cambridge knows that the colleges are *anxious* to reward proficiency in science, and that the tendency is distinctly to award scholarships therein on easier terms than in other subjects, but that there is a dearth of candidates. Although the valuable science scholarships at Trinity have always been open to members of all colleges of either university, the number of those who have tried has always been very small.

I maintain, then, that Cambridge *has* taken the initiative as far as it is desirable to do so. It would be a lamentable thing to award prizes too profusely, as we should thereby be stocking the University with an inferior staff of teachers, who would transmit their inferiority to the succeeding generation.

GEORGE DARWIN

Trinity College, Cambridge, July 30

Circulation of Apparatus and Scientific Works

THE letter of Mr. H. W. Lloyd Tanner (NATURE, vol. x. p. 244) has opened up a subject of importance to all science teachers, and surely there are no insuperable difficulties in the way of the Kensington authorities sending out for loan, under proper conditions, apparatus and scientific works. Already there are loan collections of apparatus to be obtained from South Kensington by any recognised science class, but the cost of getting up and sending them out must be far greater than necessary. We were much amused last winter by receiving from the Department of Science and Art, as a loan, *five* huge boxes of elementary chemical apparatus. When these were opened we were quite disappointed, for only a few pieces proved useful in our class. We did not want a lot of big bell jars, glass retorts, Florence flasks, and bits of glass tubing stuck through wretched corks. Anyone can easily understand that it is simply waste of money to send to a science class apparatus on loan that the class already possesses. Why are not teachers allowed to choose the apparatus? In furtherance of the object mentioned by Mr. Tanner, may I be allowed to offer the following suggestions:—

1. That a collection of scientific apparatus and standard works for loan be made at Kensington.
2. That science teachers desirous of using books and apparatus pay a subscription, say, of 10*s.* per annum.
3. That lists of apparatus and books be published, and sold to subscribers at a reasonable figure.
4. That books and apparatus (from list) be lent for a term to subscribers (subject, of course, to conditions of return in good order).
5. That the Department pay the carriage to and from Kensington.

Perhaps other readers of NATURE will kindly give further suggestions.

To such as myself, anything like the above would be a boon indeed. Living in a small country town in which there is neither public reading-room nor library, and being daily engaged in teaching science, and, withal, intensely fond of the study of it, I am thrown almost entirely upon my own resources to provide scientific books and apparatus. Yet I am better off than numbers of science teachers. The trustees of our schools have lately granted 5*l.* a year for scientific apparatus, and to this we get the Government grant of 50 per cent. added. Further, I can at any time borrow a good microscope, and have access to several private libraries belonging to gentlemen of scientific tastes. Still, frequently, the very information wanted is not to be obtained, and I for one should be glad to avail myself of any scheme like the one I have suggested.

Dunstable A. P. W.

Sounding Flames

IN the summer of 1842 I attended the lectures of Dr. William Reid, brother of Dr. David Boswell Reid, the celebrated ventilator of the House of Commons, in the great barn-like class-rooms of the latter chemist. In the practical class we produced sonorous flame vibrations in iron tubes three or four inches in diameter and about 2 ft. long, held over similar tubes covered with wire gauze. These instruments were the property of Dr. D. B. Reid, and produced a noise like the roar of a lion.

Edinburgh, Aug. 7 T. STRETHILL WRIGHT

THE FRENCH ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THIS Association, as we have already intimated, meets at Lille on Aug. 20, and thus its meetings will be held contemporaneously with those of the British Association; this is perhaps to be regretted, as some of the members of the two Associations might wish to attend the meetings of both. The Lille session promises to be as brilliant as either of the two preceding ones. The proximity of Lille to Paris is very likely to attract a greater number of members than was gathered at Bordeaux or Lyons. A considerable number of foreigners have promised to "assist" at this year's meeting; among whom we notice the names of Prof. Sylvester and Dr. Odling.

The session will be opened at three o'clock on the afternoon of the 20th, by the inaugural address of M. Wurtz, the president for 1874, and also by an address by Lieut.-Col. Laussedat, Professor at the Conservatoire des Arts et Métiers, general secretary of the Association for 1874. There will, of course, be the usual sectional meetings, and several public lectures have been arranged for. Excursions always form an important part of the proceedings of the French Association, and three have been organised for this year; the first excursion, on Aug. 23, will be to Boulogne; the second on Aug. 25, to the coal-mines of the "Compagnie d'Anzin;" the third excursion commences on the 28th, after the conclusion of the meetings, and will probably be to Brussels and Anvers, lasting several days.

To show the magnitude to which this Association has already attained, we may state that about 150 names are down as readers of papers in the various sections, several of whom are to read more than one paper. M. Cornu is to describe a new optic spherometer. Several papers are to be read by M. Marcel Deprez on improvements in electrical apparatus and on certain theoretical aspects of steam-engines. Prof. Giard, of Lille, is to make several communications in Zoology, and M. Hamy in Anthropology; Prof. Houzeau, of Rouen, is down for a paper on Concentrated Ozone; and M. Lallemand, of Poitiers, will describe his researches relative to the Diffusion of Light. M. G. Lemoine will read two papers, one on

researches in Chemical Mechanics, and the other on Equilibrium in Gaseous Systems. Prof. Terquem, of Lille, will read various papers in Optics and Acoustics, and M. G. Tissandier will give a public lecture on Meteorology and Balloons.

On the whole, there will be a fair number of purely scientific papers, though there is an unusually large proportion in medical and industrial subjects.

THE COMETS

THE following communication appears in the *Times* from Mr. J. R. Hind, F.R.S., dated Mr. Bishop's Observatory, Twickenham, August 10:—

"I send you positions of the last new comet (Borrelly) for the ensuing ten days; warning the amateur, however, that he must not expect to see it well without a very good telescope. They are deduced from the following orbit, which I have calculated from the first accurate observation at Marseilles on July 26, one at Strasburg on Aug. 1, received from Prof. Winnecke, and a third taken at Mr. Bishop's Observatory on the 4th:—

"Perihelion passage, August, 27·0861 Greenwich time; longitude of perihelion, 344° 24′ 6″; ascending node, 250° 59′ 50″; inclination to ecliptic, 41° 39′ 52″; distance in perihelion, 0·98090; heliocentric motion, direct.

"The subjoined places are for midnight:—

	Right Ascension. h. m. s.	Polar Distance. ° ′	Distance from Earth.
Aug. 10	14 33 22	20 40	0·676
,, 12	14 20 44	19 47	0·684
,, 14	14 7 27	18 59	0·692
,, 16	13 53 22	18 15	0·699
,, 18	13 38 18	17 36	0·705
,, 20	13 22 28	17 2	0·711
,, 22	13 5 55	16 34	0·717

"The distances are expressed, as usual, in parts of the earth's mean distance from the sun.

"It appears that efforts in various observatories to obtain a daylight view of the late bright comet have been fruitless. I had been most hopeful of it being thus seen with the powerful telescopes and in the favourable climate of Marseilles; but I learn from M. Coggia that a close search for the comet in fine skies on July 22, and from morning to evening on the 26th, failed to afford a glimpse of it. At Twickenham, under very advantageous circumstances, about noon on July 23, we could not detect it, when Procyon, the principal star in Canis Minor, at nearly the same angular distance from the sun, was shining brightly in the telescope. It affords additional evidence that proximity to the earth is not so important a condition for visibility of a comet in the daytime as close approach to the sun; but it was very desirable to have the appearance of Coggia's comet upon record."

THE FORM OF COMETS *

IV.

WE have seen then that the phenomena of the tails of comets can be explained even including their most complicated appearances. I now proceed to deal with other phenomena, for the best proof of the truth of a theory is its capacity to explain a multitude of details which were not at first considered. Examine in the figure (Fig. 8) which I recently showed you of Donati's comet, that singular dark portion which is seen in the axis of the tail to a very considerable distance from the nucleus, and say if that cylindrical space, void of matter, is not the effect of the interposition of a screen—the nucleus, which intercepts the repulsive force, and suppresses in this region all the molecules driven from the head of the comet. This is because the repulsive force, being a surface-action, is spent against that of the nucleus, and is arrested by this simple screen; it is quite the reverse of attraction, which acts effectually through all matter as if that matter did not exist. This cannot have been the shadow thrown by the nucleus, for two reasons, of which it is enough to mention the first: the black streak, besides being much too long, is not in the exact direction of the luminous ray; it is inclined to the radius vector at an angle of several degrees, for which the theory accounts. In short, it widens considerably when tails almost straight, composed of the rarest materials, are about to disappear, and we can often follow its trace to the extremity of the tail.

But I must dwell, in conclusion, upon the curious phenomena of the head and upon the luminous sectors which usually appear in the direction of the sun. We find here a new confirmation of the play of the repulsive force. Fig. 15 is a drawing on a large scale of the head of the comet of 1861, made at Rome by Father Secchi.

Let us not forget, in what follows, that one of the characteristic features of the nebulous layers which surround the nucleus, and of which it is perhaps entirely composed, is the transparency which permits us to see small stars through depths much greater than that of our atmosphere. There is reason, then, for believing that the solar rays penetrate across these layers to the central nucleus and heat it, all the more since these same layers are probably not so permeable to dark heat as they are to luminous heat. In the space of three weeks the central heat may thus be raised from the degree of heat of distant space to a temperature sufficiently elevated to volatilise a part of the matter of the nucleus, and perhaps promote chemical reactions arrested till then by the original cold.* Under this increasing influence the matter is dilated and rapidly separates from the nucleus (19 metres per second for Donati's comet); but soon this matter, still too dense to be sensibly repelled, reaches the surface limit beyond which it ceases to belong to the comet. This surface limit presents, as we have seen, two opposite conical points by which the emission takes place. At a later period this matter getting further and further away, and becoming more and more rarefied, falls under the action of this repulsive force, which then makes it turn tail and fly to the rear. This species of conical envelope, turned towards the sun, assumes the appearance of a calyx with inverted edges, while the opposite envelope with obscure interior contracts under the influence of the same action, but without changing its curvature. There will be noticed, in front of this species of calyx, exterior strata nearer to the sun, to which they present their convexity instead of being opened out conformably to the theory which M. Roche had hitherto based solely upon attraction. I asked M. Roche to introduce the new force into his investigation of the surfaces assumed by a fluid mass submitted to the double attraction of its own mass and of that of the sun, and we have had the satisfaction of seeing one of the two singular points of the surface limit disappear. The surfaces are completely enclosed and become curved towards the sun; there is no room on this side for any loss of matter. But this is to be expected in the exterior layers, which have too little density to obey repulsion; while in the interior of the head, very near the nucleus, attraction still rules exclusively on account of a density still very great.

In order to render these somewhat complicated details of the theory intelligible, we have only to turn round on its axis Fig. 16; it will generate a surface of revolution composed of an exterior envelope having a form roughly parabolic, and of two envelopes attached to the

* Continued from p. 270.

* Spectrum analysis seems to prove that this heat may reach the point of giving to the nucleus a light of its own, presenting, moreover, the characteristics of a light emitted by a gaseous substance. But up to the present time (1870), indications of this kind are too vague and too doubtful to enable us to derive much help from them.

nucleus, one of which is, to use a botanical term, of a cyathiform aspect, while the other is almost conical.

If we compare this theoretical figure with that of the head of the comet of 1861 (Fig. 15) and of other comets, it will account for the transparency of these surfaces and for the effects of perspective. The latter are continually changing, for comets are presented to us in all imaginable positions.* The conical anterior envelope is often described by observers under the name of a luminous sector, a term which gives a false idea of its real form. In the head of Donati's comet, the luminous sector appears to have had an amplitude very much greater than that of the comet of 1861.

You see that all the most constant, the best investigated, the most characteristic details of the figure of comets agree in disclosing the action of a repulsive force which is exerted by the sun not in virtue of his mass, but in virtue of his superficial incandescence. Extinguish the photosphere of the sun, reduce it in thought to the state of crust to which cold has long ago brought the earth, so as to leave nothing more than the solar attraction inherent in its mass, indestructible as the mass itself, and you will suppress at the same time the gigantic tails of comets and the cup-shaped emissions of their heads. They will no doubt still lose some part of their materials in approaching the sun, but these materials will be disseminated along the orbit of the comet instead of flying away from the sun into space with an incredible swiftness. In a word, comets would lose the forms represented in Fig. 7, and would assume those of Fig. 6.

FIG 15.

It may perhaps appear to you singular that we must go to celestial phenomena for evidence of the existence of a force so widespread as repulsion due to heat when it acts at a sensible distance, and not from molecule to molecule. In reality there is nothing astonishing in this; it was the same with attraction.

Each of you is firmly convinced of the existence of this force; you know that two spherical bodies attract each other in proportion to their mass, and in inverse proportion to the square of their mutual distance, and that notwithstanding that you have not had ocular demonstration, that you have not tested it by experiment; around us, within us, nothing announces to us that bodies attract each other. No direct experiment has ever been made on the point in France, and if any physicist set himself to it, he would require six months at least to prepare for what is known in England as the "Cavendish Experiment."

But if attraction produces around us effects so feeble that no mechanician or physicist ever thinks of taking them into account in his experiments and calculations, on the other hand it acts on a grand scale in celestial space on account of the greatness of the masses. Well, it is the same with the force of repulsion; on account of the incandescence of the surface of the sun, of the enormous extent of that surface, and of the small density which matters may acquire, where they have infinite space in which to expand. Although this repulsive force is acting all round us, just like attraction, it is quite as difficult to prove it, because we cannot attain by means of our furnaces the degree of incandescence of the sun, and above all because we operate only upon insignificant surfaces, and because we work in an atmosphere of an enormous density as compared with cometary materials. It is easy to see, then, that to obtain evidence it would be necessary to resort to combinations as delicate as those of the Cavendish Experiment.

We may, however, do this: the repulsive force, with all the characteristics which we have discovered in it, is yet only a hypothesis which accounts at once for the figure of comets and for the acceleration of their motion. We have connected it, it is true, by the incandescence of the sun, with the familiar phenomena of the repulsion determined by heat between the molecules of bodies; but it remains to show, by a direct experiment, the difficulties of which we have seen, that this repulsion exists beyond the infinitely small distance which separates these molecules. This experimental verification of every hypothesis is an essential thing in astronomy; by this alone can our minds be fully convinced. The physicist, on the contrary, can use more largely the convenient artifice of hypotheses, since he holds in his hand, so to speak, the phenomena which he studies, may reproduce them, call them forth at his pleasure, and regard his subjects in all their aspects. Should an hypothesis be found to contradict certain facts, the physicist imagines for them another more comprehensive which he will subject to the same process. It is not so with astronomy. That which has long been wanting to the theory of attraction in the case of many minds strongly prejudiced, moreover, in favour of another doctrine, is precisely this direct and experimental verification the necessity for which I have pointed out. Everybody did not feel, on the appearance of the *Principia*, that it was implicitly contained in the famous calculus which enabled Newton to see that the force which holds the moon in its orbit is identical with that which every-

FIG. 16.

* Moreover, the least want of homogeneity in the nucleus and a rotatory movement may considerably modify the phenomena and leave only the narrow part of the anterior calyx. But these anomalies do not take away from the phenomenon its characteristic physiognomy, even when they give, or example, to the anterior calyx, a most curious radiated aspect.

where causes bodies to fall to the ground. The learned opponents of the doctrine on the Continent would, without doubt, have been favourably disposed to it before the experiment of Cavendish or that of Maskelyne, if Newton had been able to realise to them so as to show to all eyes that bodies of suitable form and of any nature whatever attract each other in proportion to their mass and in the inverse ratio of the square of their distance.

But how are we to apply the Cavendish balance to the measurement of the repulsive force of an incandescent surface? First of all, the materials of our apparatus are of a density enormously superior to that of comets; then it is necessary to operate in a perfect vacuum, for the least trace of air which remains in the apparatus will give rise to currents under the influence of a surface strongly heated, and will thus obscure the effect which we endeavour to establish. In trying to surmount this difficulty,* I have been led to think that if I could make an incandescent surface act upon the small mass of air itself which acts as an obstacle to us in the vacuum of our best pneumatic machines, I should obtain a very appreciable repulsion; only we must find some means of rendering this air visible. The artifice to which I am about to have recourse before you consists in illuminating this rarefied air by means of the spark of Ruhmkorff's induction apparatus. (See Fig. 17.) This glass bell-jar, in which a vacuum has been made, is traversed by the two conductors of the apparatus, the one vertical and the other horizontal. You see the spark spring out under the form of feebly luminous stratifications of a peculiar rose colour; at the same time the horizontal conductor is covered with a luminous sheath of a well-marked blue colour. It is the air which is thus illuminated by the passage of the current. Remark, however, the particular form of the horizontal wire; it is formed partly of a thin blade of platinum surrounded by a blue aureole. I shall redden this plate by means of an ordinary current, composed of several Bunsen couples. I cause this current to pass through the horizontal conductor, not disturbing in the least the first induction current. The platinum plate becomes incandescent, and you soon see the blue-coloured sheath separate from the platinum plate like two lips which are parted.

I have varied this experiment to obviate the objections

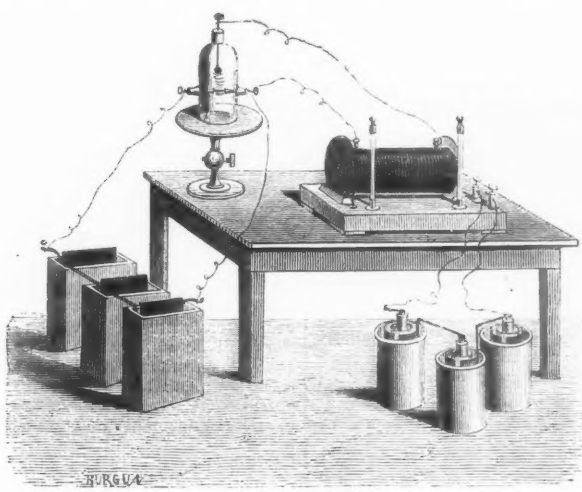

Fig. 17.

to which the increase of the conductibility of the air might give rise; but it has always succeeded. Thus have I obtained an analogous repulsion by acting transversely upon the rose-coloured stratifications; the case was absolutely the same as if a perfect vacuum existed around the plate, a vacuum of definite limits beyond which the electricity would not pass, while an increase of conductivity would simply cause the induction-spark to incline towards the favourable region and so to modify its usual configuration.

Thus have we been led to conclude with perfect certainty (1) that cometary phenomena reveal to us in the universe the existence of a second force totally different from attraction, capable of playing an important part and producing before our eyes gigantic phenomena; (2) with great probability, that this force is nothing else than the repulsion due to heat.

Perhaps we may come upon this force when we investigate more closely the strange phenomena of the solar protuberances which the brilliant discovery of Janssen and Lockyer permits us henceforth constantly to follow, or when science will be in a condition to approach the investigation of those mysterious star clusters which attraction has not been able to unite into a single sun, and which appear to us under forms so strange and withal so geometric.

Whatever may be the value of these experiments, it is of importance, I believe, to science, not to leave this beautiful question of the figure of comets without any other answer than the *je ne sais* of Arago, and it is of not less importance to natural philosophy to prove that the forces which rule the stars are none other than those which act around us at the surface of the earth. If it should displease any sage metaphysician that I have tried to establish a duality of forces in a region where he vainly flattered himself that unity reigned, I pray him to consider that, if it is possible to transform, so to speak, certain forces into each other, to produce, for example, heat by means of the concussion of a body acted on by terrestrial attraction, then electricity by means of this heat, magnetism by means of this electricity, and finally to attract a very peculiar sort of matter by means of this magnetism, we have not succeeded in the least in transforming the attractive force of the least molecule, since its weight remains invariable through all the modi-

* We could assuredly manage it, but it would be necessary to have at our disposal means of execution superior to the resources of a private individual.

fications of the forces which act upon it. The desired unity, then, was far from being realised before the appearance of that repulsive force acting at a distance which the cometary phenomena definitely inscribe in the mechanism of the heavens by the side of attraction, and which I find around us in the phenomena of heat.

At all events, we have got a great way from that judicial astrology which I felt bound to remind you of at the outset, in order to show to you the condition in which we found that branch of celestial science. While, in planetary astronomy, scarcely anything has been done for two hundred years but to develop indefinitely the mathematical formulæ of a force established and defined, we have tried here to put ourselves on the track of a force which rules more especially the cometary world, and have endeavoured to give it a name.

THE AMERICAN OYSTER-TRADE

SOME notion of the extent of the trade in oysters at Baltimore may be gathered from a recent report of the British Consul. Baltimore, it is said, is recognised all the world over as the great centre for raw oysters—New York as well as the Southern and Western States depending on it for their supplies. The packing-houses in Baltimore have agencies in all the large cities and towns, and these agencies have sub-agencies covering the country districts. About twenty firms are engaged in the packing and distribution throughout the States of raw oysters, 5,000,000 bushels of which are annually consumed to meet the demands of the trade, which is one not only incurring great risks, but also requiring some tact for its successful management. Such is the perishable nature of the oyster that the risk in handling them has much to do in determining their price. Delays in the arrival of a vessel will often cause a whole cargo to become putrid, so that it has at once to be thrown overboard. To cover these risks the margin of profit is necessarily large. Large numbers of men, women, and children are employed in opening the oysters and removing them from their shells: for this work they receive 20 cents per gallon, and the average earnings of each person are about two dollars per day of ten hours.

In packing the raw oysters they are, after being opened, washed carefully, then placed in flat cans with a little fresh water, as the liquor or natural juice of the oyster decomposes in twenty-four hours after exposure. These cans are then packed in rows with cakes of ice between them, and shipped by express to their destination. At certain points it is arranged that these cases destined for the far west shall be opened, fresh ice placed between the cans, and then re-shipped to their ultimate destination. Oysters packed in this way and re-iced at certain places on the route can be sent from Baltimore to San Francisco in good condition. Besides this trade in raw oysters as many as 3,000,000 bushels are annually steamed and hermetically sealed in tins for shipment to all parts of North America and to Europe. The season lasts from Oct. 1 to April 1. By the steaming process the oysters are so preserved that after being sealed down they will keep good for an indefinite period of time.

RUDE STONE MONUMENTS OR CHAMBERED BARROWS

I.

THE object of the present and succeeding articles is to discuss some of the opinions which are held by some of the leading antiquaries of the present day with respect to the construction, destination, and also antiquity of these monuments, and to show that, notwithstanding all the advantages presented by the establishment everywhere of Archæological Societies, the publication of their journals, and the increased facilities for travelling, many professed students of this branch of science are still found to be blindly adhering to the views of antiquaries of the past century. There is a very remarkable contrast between the progress made in the study of unchambered, and in that of chambered, barrows. We have now a much sounder knowledge of the former than of the latter, not simply because the latter are more difficult to understand, but because their study requires qualifications not possessed by every investigator. He must have long acquaintance with the monuments, sufficient dexterity in drawing and surveying to make accurate plans, sections, and elevations, be a close and unbiassed observer, and then have leisure to devote his intelligence to the scrutiny. Cursory examination will be always fatal to the acquisition of sound knowledge, and serve to mislead others; and it is greatly to be feared that this has been too common a habit and result.

The first erroneous opinion to which attention is now directed is that very many of the cromlechs or dolmens (to employ terms which are in general use), *i.e.* rude stone structures which in the British Islands and on the Continent are partially or wholly exposed to view, were never in any other condition; that is to say, that although they may be in some measure dilapidated now, yet that they were originally intended to be exposed buildings. They are aware that many other structures of analogous forms are imbedded or enveloped in mounds so as to be invisible externally, but they will not allow that the exposed ones ever were so. As long as these authors confine themselves to the bare declaration of their belief their position is not so assailable; but when they point to the monuments which they say illustrate their arguments the case is altered. The examples are open to the inspection and consideration of everybody, and the accuracy of their descriptions can be tested. This has been done, and the result has been that numberless inaccuracies have been detected in the published accounts and in the plans; and the conclusions which have been deduced from them are consequently pronounced to be erroneous.

It will be sufficient to point out this in a few of the well-known monuments to which they have directed our attention; and as no author has treated the subject so comprehensively as Mr. Fergusson, or been so methodical in the arrangement and classification of the monuments, his recent work* will be particularly referred to in the following pages. He has admitted that he is indebted for much of his information to the published accounts of others. It must be premised that we do not assert there is positive *proof* of the former existence of the mounds, nor do we say that there is any tradition of them, but we say that when the exposed monuments are compared with those which are wholly enveloped, and with those numberless instances in which the traces, in many examples very extensive traces, of the mounds still exist, the fair and legitimate inference is that these so-called "free-standing" structures† were once monuments of the same class as the others, and that they are only in a more advanced stage of decay at the present time.

We go a step further, and say that there are so *very few* instances in which no trace whatever of a mound remains that the argument from inference is greatly strengthened. Have the advocates of the theory ever attempted to sum up *carefully* all the examples of *total* denudation? It has been remarked by the author of "Rude Stone Monuments in all Countries," p. 44, that "probably at least one hundred dolmens in these islands could be enumerated which have not now a trace of any such envelope." There is a confidence in this statement which invites scrutiny, and we venture to say at the outset that it is far from being accurate, for we know that

* "Rude Stone Monuments in all Countries, their Ages and Uses."

† These are defined to be dolmens which were never intended to be hidden in any earthen covering, and about which no trace of a mound exists.

traces of mounds which in some instances no longer exist are upon record, and there is no reason for doubting the record. Immediately following the above statement, a well-known monument is brought forward as one of the unmistakeable hundred examples, and the remark is made that Kits Cotty House, near Aylesford, in Kent, "is exactly now where it was when Stukeley drew it in 1815, and there was no tradition then of any mound ever having covered it," and "we cannot now find a trace of it." But if we pass on to p. 116, where the monument is again mentioned, we find it said, "If we can trust Stukeley's drawing, it was an external dolmen standing on the end of a low long barrow," "the mound has since been levelled by the plough," and "I am inclined to place faith in the drawing." There is no tradition, it is true, of any mound having *covered* it, but how any faith can be put in the drawing, and yet it can be said that the mound has been levelled, which, it is implied at p. 44, never existed, is beyond comprehension. According to Stukeley, therefore, there was not only a trace of the mound, but its form was in his time determinable, and the stone chamber was situated near one of its extremities. This agrees admirably with the construction of many other chambered long barrows where we see the chamber either wholly or in great part enveloped. This monument, therefore, should not be included among the obvious hundred examples.

Pentre Ifan, in Pembrokeshire, is also brought forward by the same author as another remarkable example in support of the "free-standing" theory. He describes it very briefly and inadequately in pp. 168, 169, and compares it with those which "were, or were intended to be, covered with mounds." There is, he thinks, a very wide difference between it and them, for the latter, he admits, are enclosed sepulchral chambers, whereas as regards the former it never could have been erected to be hid, and "besides that, the supports do not and could not form a chamber. The earth would have fallen in on all sides," &c. Unquestionably there would be much to favour the theory, if it could be granted that the monument is in the same condition now as it always was; but it is known for certain that this is not so. There is, fortunately, a description of it written by Owen more than 200 years ago, and there is also another account by Fenton as it appeared in his day, about seventy or eighty years since, and from these we learn that the aspect of the monument was totally unlike what it is now. There were then eight or nine upright stones under the great roofing stone, now there are only three; then there were the remains round about it of a stone circle 50 ft. in diameter, not now existing; and according to the late Rev. H. Longueville Jones, there were traces, when he saw it, of the original mound. Of the eight or nine upright stones, two, or at most three, supported the capstone, which will easily account for the removal of those which gave it no support. So that in this instance, also, here is a monument which should be excluded from the hundred examples.

On a careful inspection of Plas Newydd, another of the hundred, it will be found that there is evidence both of the encircling ring of stones and of a mound.

It would not be necessary to enter into these particulars but for the oft-repeated assertion of Mr. Fergusson, "no trace of the mound can now be found either around the stones or in the neighbourhood," which is expressed in various ways, and by which he conveys the impression that no mound ever existed; and for the argument which this belief is made to sustain, an argument which we think strongly militates against the idea that all these monuments were destined for sepulchral purposes.

Before passing on to monuments of other lands it will be well to point out the error of one who, with every desire to advance archæological science, has been misled by the classification adopted by Mr. Fergusson. It will not be out of place to do so here, because the views of the writer of the present article have been assailed* by this young Cornish antiquary, who has been carried away by his zeal. In order to give support to the "free-standing" theory he enters into a description of Lanyon Quoit, a dolmen standing in the parish of Madron, Cornwall, which he thinks fully establishes it, an opinion shared by Mr. Fergusson (p. 163). But Capt. Oliver, R.A.,† has convincingly shown that the monument is not now in the condition in which it used to be; that it has been rebuilt and the position of its supporters have been altered; that these original supporters were stout stone slabs (4 ft. wide by 1 ft. 6 in. thick), and not slim pillars; that whereas there are now three, there were four upright slabs in old Mr. Borlase's time; that two more slabs are lying prostrate close to the others, which it is fair to presume were once upright walling stones of the chamber; and that the monument stands as much *in* as *on* a long mound, which bears every appearance, he adds, of having been a long barrow. It ought therefore to be struck off the list also.

Arthur's Quoit, in Gower, according to Mr. Fergusson, was probably always "free-standing;" but both Sir Gardner Wilkinson ("Archæologia Cambrensis," 1870) and the Rev. E. L. Barnwell have expressed the contrary opinion. The former believes it to have been covered with a tumulus, and the latter writes, "there are cart-loads of stones still remaining, and so little disturbed in position that their outline gives that of the base of the once existing mound." This monument therefore may rightly be excluded from the list.

The elder Borlase describes very accurately all the most remarkable exposed monuments existing in Cornwall in his day, and speaks of the traces of their mounds in every case, *e.g.* Mulfra Quoit, in the remains of a stone barrow; Bosporthenis Cromlech, once in a mound of stones and earth; and Zennor Cromlech, once in a stone barrow.

According to Norden, who described Trevethy Cromlech in 1610, it was "standing on a little hill within a feilde."‡ Lower Lanyon chamber was discovered in 1790 in a bank of earth and stones; and only one upright stone and the fallen capstone now remain. Pawton Cromlech is still partly "buried in the tumulus which no doubt formerly covered the whole" ("Nænia Cornubia," p. 32). Chywoone or Chûn Cromlech was in a barrow or cairn, 32 ft. in diameter (ibid., pp. 56, 58), and the author of this book says that it so closely resembles a dolmen at Moytura, Ireland, and another at Halskov, in Scandinavia, that the drawings of one might pass for those of the other two. This is a repetition of Mr. Fergusson's remark §—the monument "at Halskov is so like the dolmen and circle represented in woodcut 61 that the one might almost pass for the other."

The "free-standing" theory receives no support whatever from the monuments of the Channel and Scilly Islands, nor yet from those of the Isle of Man, so that the area of the British Isles is circumscribed within which the more than hundred examples are to be found. England, Wales, Scotland,¶ and Ireland contain a large number of rude stone monuments, and the area is sufficiently wide to produce as many as Mr. Fergusson supposes. But it would be a most difficult—we should say a hopeless—task for anyone to attempt to enumerate them and to hand in the required tale.

The writer of the present article has examined the group of monuments known as those of Beni-Messous, or El-Kalaa, in Algeria, and planned several of them. They are all of similar construction, and are simple cists, averaging about 7 ft. by 2 ft. 6 in. (internal dimensions)

* NATURE, vol. viii. p. 202. † Ibid. p. 344.

‡ For account and drawings see "Nænia Cornubia," pp. 46, 47.

§ Op. cit., pp. 304, 305.

¶ At p. 240, Mr. Fergusson says—"The free-standing dolmens are few and far between, some half-dozen for the whole country," which again diminishes the area.

without galleries. These cists point east and west, with slight variations, and are built with unhewn stones of the locality—tufa and pudding-stone. The mounds, which in a few instances remain intact, are small and of stone, and the chambers which are visible are in various stages of dilapidation and exposure, traces of the mounds being clearly indicated by the quantity of loose stones which are round about them. The place has served for many years as a convenient quarry for the Trappist monks of Staouli, and for the French colonists who have located themselves at Guyotville and Cheragas. If it had not been for a Government order the whole of these monuments would have been carted away for the sake of their building materials. When first discovered they are said to have numbered about 100; about 30 are now left. They are scattered over an area of a few acres, and are arranged without any regularity; and at the period of their completion must have presented a remarkable collocation of stone heaps. The late M. Berbrugger, who was Inspector-General of Historical Monuments in Algeria, was the first to make their existence known, about thirty-seven years ago. Dr. E. Bertherand, the present secretary of the Algerian Acclimatisation Society, has described them in a pamphlet printed by that Society. In 1859 Mr. A. H. Rhind communicated an article upon them to the Society of Antiquaries, London, which is printed in "Archæologia," vol. xxxviii. M. Réné Galles, the well-known explorer of Brittany dolmens, has also written about them; and the late Mr. J. W. Flower, who visited the spot in 1868, has compiled an article from the foregoing pamphlets, which he read at the International Congress of Prehistoric Archæology held at Norwich in the same year. All these writers have classified them as covered and uncovered tombs, implying, if not asserting in so many words, that the latter had never been covered; *i.e.* "free-standing." Mr. Fergusson has followed their lead, and adopted their classification; but a careful inspection of each exposed monument will convincingly prove that the stone heaps which surround them strongly testify against the theory.

When, however, our attention is directed by Mr. Fergusson to continental examples our astonishment at the glaring inaccuracies and contradictory statements is increased, and we wonder that several well-known monuments should have been brought forward to support a theory which their prominent features most clearly refute. There are two in the south of Brittany which have been described by him as belonging to the uncovered class, viz. Dol-ar-Marchand at Locmariaker, and Courconno, in the parish of Plouharnel. Of the latter, he says, "it certainly never was covered up" (p. 343). This is a plain and positive assertion; yet a few pages further on (p. 363) he writes doubtfully, if not contradictingly, on this point: it is "a magnificent cist, walled with rude stone, and such as would form a chamber in a tumulus if buried in one, though whether this particular example was ever intended to be so treated or not is by no means clear." Of the former he writes, it is "the most interesting, if not the finest, free-standing dolmen in France," and "the great stone, like that of most free-standing dolmens, rests on three points, their architects having early learned how difficult it was to make sure of their resting on more. So that, unless they wanted a wall to keep out the stuff of which the tumulus was to be composed, they generally poised them on three points, like that at Castle Wellan."

The question bears quite another aspect, however, when these monuments are carefully inspected, and the treatment they have received at the hands of the inhabitants of late years is inquired into. We thus ascertain that the great dolmen of Courconno is in a very different state now from what it was in 1847, when drawn and described by Cayot-Delandre, the historian of the Morbihan, and that it has been further curtailed of its proportions since 1854. It was then not a mere cist of gigantic size but a huge chamber to which a long covered way or passage was attached, the dimensions of which are given; and there were also traces of the enveloping mound, some of which still exist.

So, too, with regard to the great dolmen of Dol-ar-Marchand, it is not at all as described by Mr. Fergusson. Its chamber has also a long covered way attached to it, which fact he does not mention; both the chambers and the covered way are buried to a depth of several feet in the remains of a circular mound which can be measured: and regular walls line the chamber and the covered way for the express purpose of keeping out the earth composing the tumulus. All these features are incontestably visible. These monuments, therefore, do not sustain the theory.

There are other well-known examples of exposed monuments in France, respecting which a great deal might be written to invalidate the "free-standing" theory. The above will be sufficient to show upon what a weak and indefensible basis it rests.

The theory is supposed, however, to receive the strongest support from a singular monument near Confolens, near St. Germain-sur-Vienne, which is also thought to have been erected as late as the tenth or eleventh century of the Christian era. It is considered of such great importance that it has been engraved and stamped in gold upon the cover of the book which has been so often referred to. It will not be right, therefore, to pass it by. The monument is really a remarkable one, and merits a most careful study on the spot. Owing to its situation in a most out-of-the-way part of France, which entails a very fatiguing journey to reach, few archæologists have had the temerity to undertake the journey, and very few Englishmen have seen it. At a first view it is a very staggering example, but on investigation its simple history unfolds itself in a convincing manner, and quite upsets Mr. Fergusson's conclusions. In brief, it is an ancient sepulchre which has been altered and converted to another use many centuries later. The covering stone is the only remaining relic of the primitive building, and there are incised designs upon its under surface, which point to its early age and use. These designs have only been recently noticed, and the tale they disclose is unmistakeable. This monument was most certainly not a "free-standing" one in the sense implied by Mr. Fergusson, nor was it originally erected at the period he supposes.

The "free-standing" theory, having been adopted, required further confirmation than the external appearance of the monuments was supposed to give it, and its advocates have considered that it is strengthened by the "impossibility of accounting for the disappearance of the mounds," and Mr. Fergusson has followed in the wake of Baron Bonstetten,* whose accuracy of observation does not seem to have been of a high order, and has adopted his language. The Baron says that both Brittany and the Department of the Lot are "pays à dolmens apparents par excellence," by which he means, as he afterwards shows, dolmens which are now as they have always been. This observation proves that he must have given them a very cursory examination. His objection to the tumular belief is thus stated:—"Les dolmens se rencontrent les plus souvent dans des landes incultes et impropres aux défrichements par la nature même du sol. D'ailleurs, dans un but de nivellement on ne se bornerait pas à enlever le tumulus, mais on détruirait encore le dolmen. Les pierres seraient utilisées ou on les enfouirait assez profondément en terre pour qu'elles ne heurtent pas le soc de la charrue," pp. 7, 8. This objection he applies to both the Brittany and the Lot monuments; but what are the real facts? Very many, indeed the larger number, of the dilapidated or partially covered monuments of Brittany are not far from habitations, and although they may

* "Essai sur les dolmens," Geneva, 1865.

stand on uncultivated plots of ground, are surrounded by cultivated lands which are inclosed by loose stone walls. Again, numbers of chambered mounds have been wholly swept away and the materials utilised within the memory of man. Others have been partially removed, and the stone chambers reduced to ruinous heaps; and in some cases, as is well known, deep holes have been dug, and the obstructing blocks buried. And this work of destruction, which is still going on in spite of the prohibitions of the French Government and the legal penalties threatened, has been in operation for centuries. Ought not the knowledge of these facts to have been acquired by the authors, and have made them hesitate before attempting to classify monuments according to their present aspects, without carefully taking into account every possible circumstance connected with the past history of the localities in which they are situated?

Another Continental writer* has fallen into the like errors through the objectionable practice of following in the track of other authors, and seeing with others' eyes. M. da Costa, following the lead of Baron de Bonstetten, has adopted the classification of these monuments into (1) "dolmins apparentes," (2) "dolmins occultos," and (3) "dolmins construidos sobre um monticulo artificial," against which last class we shall raise a vehement protest by and by.

It results from what has been said, that what is really needed when treating of rude stone monuments is perfect accuracy of description and no omission of any detail or feature which may reasonably be supposed to be connected with the structures. Important omissions of this nature frequently occur, not intentionally, but because of the defective archæological education of the writers, and their want of experience. It is very damaging to the cause of scientific truth when such a theory as the one here exposed is asserted to be supported by examples which really tell against it. Our antiquarian ancestors, who knew very little respecting these monuments, and had few opportunities of comparing them with others in distant localities, who did not know what their true construction and destination were, and mistook the weathering effects on the capstones for channels artificially made, called these structures Druids' Altars, and invented horrible stories of human sacrifices. Assuredly, if it be once admitted that there were "free-standing" monuments which were never inclosed in mounds, then their views may not have been so very far wrong, and some of these buildings may, after all, have been erected for altars of sacrifice. There would be very little proof that they were intended for burial-places. The difference between them (especially those which one author describes as resembling "three-legged milking stools," and another calls "tripod dolmens") and the carefully covered ones, out of whose vaults the earth of the mounds is thoroughly excluded by means of walls of dry masonry, is so great and so striking that the exposed ones could scarcely be with any certainty declared to have been tombs. There is abundant evidence betokening what the covered ones were destined for, and hardly more than a mere assumption as regards the others.

W. C. LUKIS

(To be continued.)

* "Descripcao de alguns Dolmins ou Antas de Portugal," por F. A Pereira da Costa. (Lisboa, 1868.)

NOTES

As usual at this season, scientific congresses are coming thick upon us. The British Association commences its sittings next Wednesday at Belfast, when Prof. Tyndall will give his presidential address. The French Association, as we have said in another column, holds its session at Lille contemporaneously with our own. The British Medical Association commenced its yearly meeting at Norwich on Tuesday, when Dr. Copeman, the president, gave his address; and the British Pharmaceutical Conference brought its eleventh annual meeting to a close in London on Saturday last. The tone of the presidential address by Mr. T. B. Groves, F.C.S., at the last-mentioned meeting, as well as that of Mr. F. J. Bramwell, F.R.S., on the 4th inst. at Cardiff, to the Institution of Mechanical Engineers, was, we are glad to see, decidedly in favour of a more thorough education of those who desire to enter upon these callings in the scientific principles which underlie Pharmacy and Mechanical Engineering. The British Archæological Association at Bristol have been working hard and well in their own interesting department. It has become the fashion in certain quarters to speak slightingly of these annual meetings as being meetings for mere talk and enjoyment; they may be so, but it seems to us that, on the whole, the proceedings prove that much really good hard work is being done year after year in all scientific departments; and it is surely something gained that scientific congresses should have come to be regarded as "popular," and should have all the important cities in the kingdom eager for the honour of their presence.

THE following are the titles of the Evening Discourses to be given at the Belfast meeting of the British Association:—Friday, Aug. 21, by Sir John Lubbock, Bart., F.R.S., "On common Wild Flowers considered in relation to Insects;" Monday, Aug. 24, by Prof. Huxley, Sec. R.S., "On the hypothesis that Animals are Automata; and its history."

THE following foreigners and members of the British Association, among others, have signified their intention of being present at the meeting in Belfast:—Dr. Schweinfurth, Prof. Knoblauch, Prof. Gluge, M. Khanikof, Prof. Delffs, M. Bréguet, Prof. Stoletoff, M. Mannoir, Dr. Williamson, Dr. Hooker, Prof. Stokes, Prof. Adams, Dr. Tyndall, Lord Rosse, Prof. Tait, Prof. Clerk Maxwell, Prof. F. Fuller, Lord Enniskillen, Lord O'Hagan, Prof. Jellett, Mr. Huggins, Dr. Balfour, Dr. Carpenter, Prof. Huxley, Dr. Crum Brown, Prof. Herschel, Prof. W. G. Adams, Mr. Stoney, Dr. Roscoe, Dr. Maxwell Simpson, Prof. G. Foster, Mr. Young, Prof. Hull, Prof. Geikie, Prof. Harkness, Major Wilson, Dr. Odling, Sir John Lubbock, Mr. Bramwell, Prof. James Thomson, Mr. Crookes, Dr. Gwyn Jeffreys, Admiral Ommaney, General Strachey, General Smythe, Col. Strange, Capt. Galton, Mr. Spottiswoode, Prof. Michael Foster, Mr. Ray Lankester, Prof. Clifford, Mr. T. W. Glaisher, Mr. F. Galton, Dr. Pye Smith, Mr. Rodwell, Mr. Chandler Roberts, Prof. Rowney, Prof. Corfield, Dr. W. Farr, Col. Grant, General Alexander, Col. Home, General Jenkins, Capt. Jenkins, Lieut. Conder, Major St. John, Dr. Debus, Mr. Paxton, Mr. Seeley, Prof. Thorpe, Prof. Thiselton Dyer, Mr. Miall, Mr. Symes, Mr. Corbett, Mr. Shoolbred, Mr. Thomas, &c.

DR. COPEMAN, in his presidential address at the Norwich meeting of the British Medical Association, spoke of the impossibility of regular practitioners being able to engage in pure scientific research. "All persons engaged in physiological research," he said, "ought to be provided with sufficient means to enable them to devote their whole time and attention to their work, without the cares and troubles of practice; while, on the other hand, those who were engaged in the great and paramount object of curing disease could not possibly spare the necessary time for minute physiological investigations. Each, however, could materially assist the other; the practitioner could furnish facts and observations which might greatly assist the physiologist in his experiments, and the latter could enlighten the former by giving reasons for the facts presented to his notice. The majority of medical men must be practitioners and earn their living by practice; but he hoped that in a society like the British Medical Association means would before long be found to supply the

necessary funds to a certain number of gentlemen with young and healthy minds congenial to the work to enable them to devote their time and energies to physiology as a separate study."

IN many French daily newspapers predictions of the future weather have been recently given, which were attributed to the Paris Observatory. Although the Observatory, however, published nothing on the subject, the statement was so widely believed that M. Leverrier felt it necessary to protest against it in his *Daily Meteorological Bulletin*. French meteorology, as we recently intimated, is undergoing a reorganisation in consequence of the vote of the Council of the Observatory. No final decision has been arrived at, although we learn on M. Leverrier's authority that a decision may be speedily expected. We hope to be able to give details when the arrangements have been finally made.

THERE is some hope that an Arctic expedition of discovery may be despatched in the spring of 1875. The Prime Minister has undertaken to consider the subject carefully in all its bearings, and on the 1st of this month the presidents of the Royal Society and of the Royal Geographical Society, accompanied by a gallant admiral of long Arctic experience, had a preliminary interview with Mr. Disraeli.

THE French Alpine Club has sent a party of ten young men under the guidance of M. Albert Tissandier to travel on the Alps and draw up a r. port of their excursion; others will be sent next year, this being the inauguration trip of the society.

FROM a recent report on the trade of Bremen we learn that a branch of industry, which is gradually increasing in importance, has arisen of late in the barren moorlands of North-western Germany by the preparation of peat or turf. This material is largely used in Germany as fuel both in private dwelling-houses as well as in some large establishments, and, it is stated, also on the Oldenburg Railway. Two companies have lately been formed in Oldenburg for the purpose of manufacturing peat on a large scale, and of supplying it to the inhabitants of Bremen, Oldenburg, and other towns in the neighbourhood, at a far cheaper rate than that now paid to the peasants, who have hitherto almost had a monopoly of the trade in this article. The peat is cut out of the soil of the marshy moors or bogs which extend from Bremen to the Dutch frontier, by machinery; by the removal of the peat a network of canals is formed, which are of use for conveying the peat itself to market, and which likewise form new permanent channels of communication available for all other purposes. The peat-cutting machine consists of a large flat-bottomed steam-vessel, which, when set to work, is able to cut a canal 20 (German) ft. in breadth and 6 ft. in depth, whilst proceeding at the rate of from 10 to 12 ft. per hour. The soil thus cut out by this floating peat manufactory is lifted into the vessel by steam power, and after being thoroughly ground is deposited, by means of a long pipe running out of the side of the vessel, alongside the bank of the canal, where it is subsequently cut into the shape of bricks and dried. It is stated that by this method about 1,000 centners (55 tons English) of a very good kind of peat may be manufactured per day. In view of the present high price of coal, particularly in Britain, and of the great importance which attaches to the question of obtaining a cheap kind of fuel at all times, it might perhaps be well worth while to consider whether this system of peat manufacture could not be introduced in many other parts of Europe, where the soil is doubtless as well suited for the purpose as in Oldenburg.

IN the *American Journal of Science and Arts* for August, Prof. A. W. Wright, of Yale College, describes his polariscopic observations of Coggia's comet. On the evening of July 6 the polariscope showed the bands, both bright and dark, quite definitely, and they were seen with comparative ease. Observations repeated a number of times agreed in showing that the light was polarised in a plane passing through the axis of the tail, that is, as nearly as could be estimated, in a plane passing through it and the sun. Other observations made on the evening of July 14, when the sky was quite clear, gave the same result, though less satisfactorily, as the twilight had begun to interfere with the observations. After waiting until this had disappeared, it was possible to see the bands, though with some difficulty, and the degree of the polarisation appeared to be decidedly less than on the previous occasion. The circumstances were too unfavourable to admit of any determination of the percentage of light polarised, but it was certainly not large. The fact of polarisation shows that a considerable portion of the light of the coma is derived from the sun by reflection.

A COMPANY has been formed to work the sulphur deposits at White Island, a marine volcano 140 miles from Auckland. It is estimated that 100,000 tons of sulphur in an almost pure state are lying on the island ready for shipment. Chemical works are likely to be established soon, and the island leased.

A NEW university will be opened at Agram, in Croatia, in October next. It will have the name of the "Francis-Joseph University."

H.M.S. *Shearwater* left Capetown on July 14 for Mauritius, with the members of the expedition who are to observe the Transit of Venus from that island.

DETAILS appear in the *Times* and *Daily News* of the expedition of H.M.S. *Basilisk*, which, as we have already (vol. x. p. 215) intimated, has been exploring the north-eastern shores of New Guinea. The ship had arrived at Singapore at the end of June, the expedition and the survey of Goschen Strait and the coast from East Cape to Cape Rigny, of the Astrolabe Gulf—about 500 miles—having occupied four months. Lieut. Dawson was to return on July 15 by Torres Straits to Sydney, whence he proceeds to Fiji to survey and report upon the harbours and passages. Riche—the island of D'Entrecasteaux, who visited these coasts in search of La Perouse in 1793—was found not to exist now. To the large D'Entrecasteaux group the names of Normanby, Fergusson, and Goodenough were given by Capt. Moresby. The coast was varied in feature, being at times bold and steep, with lofty mountains, at others low and wooded, with off-lying coral banks and dangers. The natives became less friendly as the expedition went westward. Venomous snakes were found, but no wild animals. About 300 miles westward of East Cape the natives were stark-naked and more debased. Collections of implements, articles of dress, and ornaments were obtained in great quantities; among the former, tortoise-shell axes and models of the war canoes. A few botanical and natural history specimens were obtained by the medical officers, as well as a rough vocabulary of the language. At Amboyna (Dutch settlement) the *Basilisk's* officers met Mr. Alexander Miclucho Macleay, the Russian traveller, who had recently returned from the north-west coast, where the natives had been hostile and had eventually ousted him. Full of zeal in his work, he had overdone it, and was suffering at Amboyna from scurvy, and afterwards erysipelas. The Dutch medical authorities thought his condition serious when the *Basilisk* left Amboyna. The surveys of the *Basilisk* have opened up a new route to Sydney, which is 280 miles shorter than the shortest previously known route.

MR. HENRY SKEY, of the Observatory, Dunedin, Otago, New Zealand, writes in reference to the mention which is made in NATURE, vol. vii. p. 25, of Prof. Capocci's idea of constructing a revolving mercurial speculum for a reflecting telescope, that he would like to know if such an instrument has actually been constructed. The same idea, Mr. Skey states, presented itself to

himself, and he also constructed a telescope on this principle many years ago in England without knowing that the method was engaging the attention of others. He sends an account of a mercurial reflecting telescope exhibited by him before the New Zealand Institute, Nov. 19, 1872, which is published in the Transactions of that Institute, vol. v. p. 119.

THE *Times* of Monday and Tuesday contains some interesting details concerning Col. Gordon's African Expedition from one of his staff. The latest date is June 18, when the various detachments were in boats on the White Nile, making the best of their way to Gondokoro. One of the objects of this expedition, as our readers no doubt know, is to carry out the work so well begun by Sir Samuel Baker in the suppression of slavery. Col. Gordon expects to have steamers on Lake Albert Nyassa by November next; and the Rev. H. Waller, writing in the *Times*, states that by taking the Suez, Souakim, Berber, and Khartoum route, it is quite possible to reach Gondokoro in forty-eight days from England, including a week's rest at Khartoum.

IN the "Tijdschrift voor entomologie nitgegeven door de Nederlandsche entomologische vereeniging" is a useful paper On *Acentropus* (Curt.), by Mr. Ritsema. He refers to the passage in the preface to the *Zoologist* for 1857: "We have an aquatic section of Diptera, Neuroptera, Coleoptera and Hemiptera; it is in perfect accordance with the known laws of Nature that there should be an aquatic section of Lepidoptera;" and he quotes the opinion given by Dr. Hagen in July 1856, that *Acentropusniveus* is a lepidopterous insect of the family Crambidæ. He then gives in chronological order extracts from writers in different countries who regard *Acentropus* as lepidopterous, and adds in conclusion a list of the streams and ponds where it has been found. Stephens, in 1835, raised the question whether his *Acentropidæ* ought not to be placed under Lepidoptera, but Dr. Ritsema does not quote him.—There is also a continuation of a new catalogue of the Hymenoptera of the Netherlands, by Snellen van Vollenhoven, with localities and list of synonyms. 1,072 species are enumerated, of which 13 are described in full as new to Science.—Dr. Ritsema describes the male of a Xylocopa, of which he says he knows only some eight or nine examples, and of which there is no specimen mentioned in the British Museum Catalogue. He gives two coloured figures.

AN Entomological Club has been formed at Cambridge, Massachusetts, having for its object the mutual interchange of discoveries and observations in regard to entomology. It has been determined to undertake the publication of a monthly organ to be called *Psyche*. This will contain such a part of the proceedings of the Society as are considered of general interest, communications, lists of captures, and especially a *Bibliographical Record*, in which will be given a list of all writings upon entomology published in North America, and all foreign writings upon North American entomology from the beginning of the year 1874. The editor is Mr. B. Pickman Mann, of Cambridge, Massachusetts. The first number contains an article by Mr. Scudder, on the English names for butterflies, and the first part of the *Bibliographical Record*.

WE have received from the Royal Observatory, Cape of Good Hope, "The Cape Catalogue of 1,159 Stars, deduced from Observations at the Royal Observatory, Cape of Good Hope, 1856 to 1861, reduced to the epoch 1860," under the superintendence of E. J. Stone, F.R.S., H.M. Astronomer at the Cape.

WE learn from the *Gardener's Chronicle* that there is to be an exhibition of useful and noxious insects during next month at the Tuileries, Paris. The exhibition commences on the 6th and is under the auspices of the Société Génerale d'Insectologie. In a country where the vines are being devastated by *Phylloxera* and where an epidemic disease has been spreading among the silk-worms, the value of such exhibitions cannot be over-estimated.

A PAPER by Mr. N. Whitley, C.E., entitled "The Palæolithic Age Examined," read before the Victoria Institute, has been published (Hardwicke) in a separate form, along with the subsequent interesting discussion, in which Dr. W. B. Carpenter, F.R.S., Mr. John Evans, F.R.S., Mr. W. C. Borlase, Mr. Charlesworth, and others took part.

MESSRS. BLACKWOOD and Sons have in the press and nearly ready for publication, "Economic Geology; or, Geology in its relations to the Arts and Manufactures," by David Page, LL.D.

MESSRS. LONGMAN will shortly publish the following works bearing upon Science:—"The Primeval World of Switzerland," by Dr. Oswald Heer, translated from the German and edited by James Heywood, F.R.S.; this work will be illustrated. "The Sun: an account of the principal modern discoveries respecting the Structure of the Sun of our System," by Father Secchi, translated and edited by Richard A. Procter. "The Star Depths; or, other Suns than ours," by Richard A. Procter. "An Introduction to Experimental Physics," by Adolf F. Wermhold. And a new edition of Dr. Neil Arnott's "Elements of Physics," edited by Alexander Bain and Alfred Swain Taylor.

M. GÖPPERT has issued a little "Guide to the Royal Botanic Garden of the University of Breslau," containing an interesting account of its various collections, and of the most important plants grown in it, illustrated by a map.

WE have received Mr. Ellery's *Monthly Record* of observations taken at Melbourne Observatory in December and January last. The mean temperature in the former month was 67·2°, being 3·6° higher than the last fifteen years' average, and the highest on record with one exception. The highest temperature in the shade was 101·2°, the range in the month being 56·3°.

THE most recently published parts of the new edition of "Griffith and Henfrey's Micrographic Dictionary" bring the work down as far as "Mouth." The publication continues to maintain its high scientific character.

THE additions to the Zoological Society's Gardens during the past week include two Egyptian Gazelles (*Gazella dorcas*) from Egypt, presented by Mr. G. Muscat; four Rufous Tinamons (*Rhynchotus rufescens*) from the Argentine Republic, presented by Mr. Alfred O. Lumb; three Mastigures (*Uromastix sp.* ?) from Persia, presented by Captain Phillips; one Yaguarundi Cat (*Felis yaguarundi*) from South America, deposited.

U. S. WEATHER MAPS

THE *American Journal of Science and Arts* for July contains an article on Results derived from an Examination of the United States Weather Maps for 1872 and 1873, by Elias Loomis, Professor of Natural Philosophy in Yale College.

Prof. Loomis had a number of outline maps of the United States prepared, and on these he traced the tracks of all the storms, whenever a storm-centre could be satisfactorily located, for two successive days, the maps exhibiting, on the aggregate, storm-paths for 314 days. These results were then reduced to a tabular form by measuring with a protractor the bearing of each storm-path with reference to a meridian, and measuring the daily progress of the storm on a scale of inches. This table showed the date of each storm, the velocity of its progress, the direction of its path, together with readings of the barometer before, during, and after a storm, and from it were calculated the following:—The average direction of the storm-paths for two years was 8° to the north of east, and the average velocity was 25·6 miles per hour. July is the month in which the course is most south, and October in which it is most north. February

is the month of greatest, and August of least velocity, the former exceeding the latter by 75 per cent. In some instances a storm-centre has remained stationary for twenty-four hours, and in four cases it travelled 1,200 miles in that time. In one case a speed of 57·5 miles per hour was reached. In April 1873 a storm-centre changed its path 360° in 24 hours. Taking into account the actual motion of a storm-centre from hour to hour, it seems that a storm-path may have every possible direction, and the velocity of progress may vary from 15 miles per hour westward to 60 miles per hour eastward.

The fall of rain seems to have a decided influence in modifying the course of a storm-path. The rainfall area is usually much larger to the east of a storm-centre than the west, 500 miles being the average length on the east side. There is a connection between the velocity of the storm's progress and the extent of this rain area—for example, when the eastern extent is 100 miles greater than the mean (500 miles), then the hourly velocity increased 14·9 miles beyond the mean (25·6), but when the eastern extent of the rain area is 100 miles less than the mean, the hourly velocity of the storm's progress is diminished 8·1 miles.

As to the direction in which the rain area is most extended, the axes of the areas were compared with the storm-paths, and gave this result, that the average course of a storm-path for twenty-four hours coincides very closely with the position of the axis of the rain area for the preceding eight hours.

Prof. Loomis says: "The progress of a storm eastward is not wholly due to a *drifting*, resulting from the influence of an upper current of the atmosphere from the west, but the storm works its own way eastward in consequence of the greater precipitation on the eastern side of the storm. Thus the barometer is continually falling on the east side of the storm and rising on the west side, in consequence of the flowing in of colder air on that side."

In order to trace the influence of the wind's velocity upon the progress of storms, Prof. Loomis divides a circle into four quadrants, and by an arrow in each, showing the average direction of the wind, it is at once perceived that there is a strong tendency of the winds inward to the centre of the storm; but the average direction in each quadrant differed from what it would be if the wind revolved in a circle round the storm-centre.

The velocity is greatest in the west quadrant and diminishes in the successive quadrants as we pass round the circle from west by south to north. On each side of the storm's centre the wind blows obliquely inward, and hence it is inferred that in the central region of the storm there is an upward motion of the air, and this is the cause of the precipitation of vapour; that is, the cause of the rainfall.

The average rise of a barometer for twenty-four hours in the rear of a storm is sensibly greatest when the velocity of progress is greatest. Prof. Loomis believes it is possible to predict where a storm-centre will be at the end of twenty-four hours.

His inquiries into the relation between the velocity of the wind and the velocity of a storm's progress have led to the conclusion that at a height of 6,000 ft. in the western quadrant of a storm the velocity of the wind is 68 per cent. greater than the velocity with which the storm advances.

He then considers how to determine whether a storm is increasing or diminishing in intensity, and concludes that when the barometer rises more rapidly than usual as the storm passes by, the pressure at the centre of the storm is increasing; but when in the rear of the storm the barometer rises less rapidly than usual, the pressure on the centre is diminishing or the storm is increasing in intensity. Sections on "The Form of Isobaric Curves," on "The Classification of Storms," and "Where do the Storms which seem to come from the far west originate?" conclude the article.

SCIENTIFIC SERIALS

The Geological Magazine, August.—This number contains five original articles. 1. Notes on fossil Orthoptera related to Gryllacris, by A. H. Swinton. The fossil remains are two from the eocene and three from the coal formation. The two eocene are, *Gryllacris Ungeri* of Heer, and *G. Charpentieri* of Heer. The coal species are, *Gryllacris lithanthraca*, two species, and *Gryllacris* [*Corydalis*] *Brongniarti* (Aud.). In the specimen *G. Brongniarti* there are indications of the "file," on which Mr. Swinton remarks: "We see this ancient instrument of music had already attained to all appearance an efficiency at least thrice that of our modern house cricket, and must have emitted notes that rang widely over the tropical forests that clothed our island in the old days of the coal period."—2. On the Source of Volcanic Heat, by Mr. G. Poulett-Scrope. Four-and-a-half pages are occupied in disavowing the views "saddled" upon him by Mr. Mallet, and in saying that Mr. Mallet's "definition" is a statement of a series of conjectures.—3. On the Glacial Epoch, by Mr. Croll. This is a continuation of the article commenced last month. The probable thickness of the Antarctic ice-cap was then considered, and now the results of the melting of a portion of it are calculated. The Antarctic ice-cap is equal in area to 1–23·46 of that covered by the ocean; therefore 25 ft. 6 in. melted off would raise the general level of the ocean one foot, and one mile melted would raise the level 200 ft. Mr. Croll takes for the time of his calculation the period when cold was increasing in the northern hemisphere and warmth in the southern. The lessening of ice-cap in the southern and an accumulation of ice in the northern would displace the centre of gravity of the earth leading to a rise in the sea-level in the northern hemisphere. This, with the rise resulting from the melting, Mr. Croll calculates would give for the latitude of Edinburgh a rise of sea-level of 800 to 1,000 ft. The supposition of the subsidence of land during our glacial period may therefore, he argues, be dispensed with; and he proceeds to show how this theory avoids many difficulties which the elevation and subsidence theory leads to. Further: the oscillations of sea level resulting from the displacement of the earth's centre of gravity throw light on many obscure points connected with the geographical distribution of animals and plants. For example, during the warm periods the English Channel would be dry land, and during the cold animals might cross to England from the north upon a frozen sea. And still further: if we knew (1) the extent of the general submergence of the glacial epoch and (2) the present amount of ice in the southern hemisphere, we could determine whether or not the earth is fluid in the interior.—4. Geological notes from the neighbourhood of Cairo, by John Milne. The article, which is too long for us to notice, is illustrated by a section and sketch maps.—5. The Red Chalk in Yorkshire, by the Rev. J. F. Blake. The paper principally refers to the occurrence of *Ammonites Deshayesi* in the red chalk, in the pebble-beds below it, at Hunstanton, in the Specton clay, and in the gault of Folkestone. The chalk is a deep-sea deposit, and in the sinking of the land in Upper Cretaceous times the passage beds from the Upper Neocomian to the Aptien were laid down in various areas from various sources. *A. Deshayesi* evidently lingered on during the time these changes were taking place till the red chalk set in in Yorkshire and the gault at Folkestone.—Among the reports is a notice of the Cotswold Club visit to Bath and a *résumé* of a paper, read by Dr. Wright, On the genesis of the oolites.

Proceedings of the Liverpool Naturalists' Field Club, 1873-74.—This club, which is fourteen years old, we are glad to see continues in a flourishing condition as regards members and funds, and has, during the session 1873-74, been doing a fair amount of work. The present number of the Proceedings contains the address of the president, the Rev. H. H. Higgins, at the annual meeting, in which he touches on a variety of topics more or less connected with Natural History; following this is a list, prepared by Mr. Higgins, of all works bearing on the Natural History of the district of Liverpool from 1705 to the present time. The club made ten excursions during the summer and autumn of 1873, and an account of these, with the detailed results of some of them, occupies part of the number. Appended is a list of excursion prizes to be competed for this summer, and the names of last years' winners.

Proceedings of the Winchester and Hampshire Scientific and Literary Society, vol. 1, part iii. (1872-3).—We learn from the Fourth Annual Report of the society that as a consequence of altering the rules so as to admit ladies, several ladies have become members. We are glad to see also that sections have been formed for the special study of botany, entomology, and zoology, and that work has already been done in each of these departments. During 1873, eighteen papers have been read in the society, most of them on subjects connected with science. In an introductory lecture, the Rev. E. Firmstone gives an interesting *résumé* of what is known about the "Star Depths." Among the other papers we would note an ingenious one On the probable origin of flints, by Mr. A. Angell, jun.; "The Heraldry of the World," a long paper, amply illustrated, by Miss Zornlin;

On some of the parasitic fungi common in the neighbourhood, by Mr. F. J. Warner, F.L.S.; Notes on new or rare Hampshire insects, by the Rev. W. Spicer; and an interesting paper on Lapland.

THE *Geographical Magazine*, August.—This number opens with an interesting account, illustrated by a map, of the Cameron African Expedition up to the beginning of the present year. In "The Lufiji River and the Copal Trade," some account is given of recent explorations of the delta of this little-known African river. Capt. Davis continues his notes on the voyage of the *Challenger*, Mr. G. Turner his "Impressions of Jamaica," and Mr. H. P. Malet his "Sign-posts on Ocean's Highway," in which he brings together various theories on the formation of mountains. "Djetyshahr (Eastern Turkestan), its Sovereign and its Surroundings," is the title of a paper, with a map, by Mr. R. Michell. In an article on "The Archæological Survey of India," an account is given of some important discoveries recently made among the Buddhist remains of Bharahut, in the Central Provinces. The number also contains a very interesting account of a recent visit to the Caroline Islands.

Bulletin de la Société d'Anthropologie de Paris, t. viii.—The diminution in the population of France which had taken place between the census of 1866 and that of 1872, and is far in excess of what may be referred to losses in battle and the annexation by Germany of the Alsace-Lorraine territory, has been made the subject of a series of papers by M. Bertillon. The whole subject of the decrease of the population in France is one that is necessarily engaging the attention of medical as well as statistical writers. In the discussion which M. Bertillon's paper raised at the ordinary meeting of the Society, M. Lagneau drew attention to the results given in a paper read by himself before the Académie de Médecine On the census of 1872 and the condition of the population of France, in which he has attempted to show that the small number of births when compared with the deaths is to be referred, not to any special ethnogenic or climatic relations, but rather to the influence of certain laws of succession and subdivision of property, and to the agency of military enactments, the one inducing late marriages and the other enforcing celibacy on a large proportion of men in the prime of life.—A valuable Report has been drawn up under the direction of the Commissioners for Algeria, by M. le Général Faidherbe and others, on the anthropology of that province, and has been formally presented to the Anthropological Society of Paris. After a general preliminary dissertation by M. Faidherbe on the different races which have occupied or still occupy the Algerine territory, Dr. Topinard considers at great length the ethnological, social, moral, linguistic and other relations of the Arabs and Berbers, who constitute the main branches of the French tributary tribes.—M. Roujou attempts in a lecture, which he delivered before the Society in the course of last year, to prove that a fair-haired race occupied the Gallic soil before the advent of the Germanic tribes, including Gauls under that denomination. He is of opinion that the ancestors of the Hellenes, the constructors of those megalithic remains which extend from the Atlantic to the Indian Ocean and from Scandinavia to Africa, and the fair-haired invaders of Egypt, who sixteen or seventeen centuries before our era had reached the Nile from the north-west, all belonged to one ancient blonde race, which long before the appearance of Teutons and Gauls had occupied Western Asia, Northern Africa, and the lands of Europe as the dominant or aristocratic class. M. Roujou discusses the much-vexed question whether the primitive Celtic races were fair or dark, dolichocephalic or brachycephalic, the former opinion being maintained by Dr. Pruner Bey, while the latter view is supported by all the learning that the great anthropologist, Dr. Broca, can advance in its favour.

Annali di Chimica applicata alla medicina, vol. lviii. No. 6, June.—This part concludes the eighteenth volume and contains the following papers:—In pharmacy, G. Righini furnishes a contribution on the iodides of sodium and ammonium and the production of iodoform in a mixture of these salts.—Dr. Coutinho furnishes a paper on the use of *Jaborandi*, a tree growing in North Brazil.—There is also a paper in this section on Anglo-Saxon condensed milk, reprinted from *Le Mouvement Médical* for March.—In hygiene, there is a paper by Pietro Carpani On a simple method for determining the quantity of lead contained in pewter vessels.—Action of water on lead, by Fordos.—In dietetics, Dr. F. Turbacco furnishes the concluding part of his paper On cheese and its alimentary use.—In physiology, Dr. G. Cappelli has a communication On the anti-fermentative action of boric acid and its efficacy in certain diseases.—Studies relating to the question of heterogenesis, by Prof. G. Cantoni.—Under the heading "Varieties" there is a paper by Gioachino Curti On the substitution of the earth of the *solfatara* of Pozzuoli for sulphur in the sulphurisation of vines.

Gazzetta Chimica Italiana, fascicolo iv.—This number commences with a paper by Prof. E. Pollacci On the mode of action of sulphur on calcium carbonate. Dr. Giuseppe Bellucci furnishes also a contribution on the same subject.—Chemical analysis of a marine plant (*Posidonia oceanica*, Koen) used in Liguria as manure, by Fausto Sestini.—Hugo Schifl contributes a paper On some derivatives of phloretine. The author describes in detail the method of preparing this substance, also the preparation of phloroglucine, phloretic acid, phloroglucide and triphloretide.—A. Pavesi and E. Rotondi give an account of the work done in the chemical laboratory of the Agricultural College of Milan. This comprises papers On rice oil; On the analysis of volcanic ashes which fell at Naples; the solubility of calcium phosphate in sulphurous acid; On parabussine, a new alkaloid contained in *Buxus sempervirens* (the sulphate has the formula $C_{26}H_{48}N_2OSO_4H_2$); On a practical method of determining the degree of acidity of milk; and, finally, On the quantitative determination of tannin especially in the must of grapes and in wine, modification of Flek's method.—The following papers are communicated from the station at Asti:—On the chalkiness of must, by Dr. I. Macagno.—Influence of light on vegetation, by the same author.—Experiments on the process of fermentation, by the same author.—The remainder of this part consists of a summary of foreign journals.

SOCIETIES AND ACADEMIES

LONDON

Royal Horticultural Society, August 5.—W. A. Lindsay in the chair.—The Rev. M. J. Berkeley called attention to *Fuchsia procumbens*, an interesting species—probably nearly hardy and suitable for rockwork—from New Zealand; *Pavia macrostachya* and *Clethra arborea* were sent from the gardens of Syon House.—Mr. H. B. Hennel exhibited a large plant of *Lilium auratum* with two stems—one fasciated, bearing forty-eight, and the other seventeen flowers.

PHILADELPHIA

Academy of Natural Sciences, Feb. 3.—Dr. Ruschenberger, president, in the chair.—Dr. Chapman exhibited a dissection of one of the hind legs of a musk-rat, *Fiber zibethicus*. The tendons of the tibialis anticus, extensor proprius hallucis, and extensor longus digitorum, pass down a groove in the tibia and under a little process of bone. The extensor longus digitorum is held down by an additional process. This arrangement seems to quicken the extension of the foot, and is of use apparently to the animal in swimming.—Prof. Leidy remarked that while it was exceptional to find the same species of the higher sub-kingdoms in the different parts of the world, it appeared to be the rule that most species of *Protozoa* were found everywhere under the same conditions. A large number of our fresh-water forms he had recognised as the same as those described by European authors. A less number of species are probably peculiar to every region. Among our fresh-water *Rhizopods* he had observed not only the genera *Amœba*, *Arcella*, *Difflugia*, *Euglypha*, *Trinema*, *Lagynis*, *Actinophrys*, &c., but also most of the species of these as indicated by European naturalists. It is an interesting question whether our fresh-water *Protozoa* have reached us from the same sources as those of Europe and other remote countries. If derived from the same sources they were probably infused in the waters of the different continents at an early age when the latter were not separated by ocean barriers. If thus early infused we have a remarkable instance of a multitude of specific forms retaining their identity through a long period of time. Such a view might appear to oppose the doctrine of evolution, but not justly so, for the simplest forms would be the slowest or least likely to vary, while the most complex, from their extended relationships, would be most liable to variation. Perhaps, however, the simplest forms of life, of the same species, may have originated independently of one another, not only in different places, but also at different times, and may yet continue to do so. While the highest forms of life may have been slowly evolved from the

simplest forms of the remotest age, equally simple forms may have started into existence at all times down to the present period. From the later original forms new ones may have been evolved to speed towards the same goal as those which preceded them.

Feb. 17.—Dr. Ruschenberger, president, in the chair.—Prof. Leidy made some remarks on the mode of reproduction and growth of the *Desmids*. In illustration he described a common species of *Docidium* or *Pleurotænium*. This consists of a long cylindroid cell constricted at the middle and slightly expanded each side of the constriction. When the plant is about to duplicate itself the cell-wall divides transversely at the constriction. From the open end of each half-cell there protrudes a colourless mass of protoplasm defined by the primordial utricle. The protrusions of the half-cells adhere together and continue to grow. The bands of endochrome now extend into the protrusions and subsequently keep pace with their growth. The protrusions continue to grow until they acquire the length and form of the half-cells from which they started. The exterior of the new half-cells thus produced hardens or becomes a cell-wall like that of the parent half-cells. In this condition two individuals of *Docidium* are frequently observed before separation. During the growth of the new half-cells the circulation of granules in the colourless protoplasm is quite active. In a species of *Docidium* $1\frac{1}{2}$ mm. long by $\frac{1}{10}$ mm. broad, the growth of the new half-cells was observed to be at the rate of about $\frac{1}{3}$ mm. in an hour.

March 3.—Dr. Ruschenberger, president, in the chair.—Prof. Leidy read an extract from a letter relating to mammalian fossils in California, from Dr. Lorenzo G. Yates, of Centreville, Alameda County, California.

March 10.—Dr. Ruschenberger, president, in the chair.—Elevation of the trunk of trees.—Mr. Thomas Meehan suggested on a former occasion that trees growing on a rock, by the natural thickening of the roots beneath would lift the tree four inches in forty years. Since that time, however, Dr. Lapham, the botanist, and State geologist of Wisconsin, had suggested to him that frost gradually lifted trees so that the trunk would sometimes appear in time to have elongated a foot or more. Since Dr. Lapham had made the suggestions, he had examined trees in the vicinity of Philadelphia and found unmistakable evidence that large numbers of trees had been raised in the manner stated. It was likely that one of the chief offices of the tap roots was to guard the tree from this frost-lifting as much as possible. His impression was that the trees of tropical climates had not near the development of tap roots which are found in the more northern ones, but this was a matter for further investigation.

March 24.—Dr. Ruschenberger, president, in the chair.—Prof. Leidy read a paper on *Actinophrys sol*.

VIENNA

Imperial Academy of Sciences, March 26.—Prof. Freih. von Ettingshausen presented a memoir On the history of the development of terrestrial vegetation. The first part treats of Tertiary floral elements and the genetic relation of these to present flora; the second, the elements of European flora.—Dr. Schrötter spoke on the transformation of ordinary into amorphous phosphorus, through action of electricity, and described three forms of apparatus prepared by Dr. Geissler, of Bonn, for the purpose. There is evidence that the change is wrought neither by the light nor by the heat accompanying the current, but by the electricity itself.—Dr. Meyer presented a second paper On new and imperfectly known birds of New Guinea and the islands of the Bay of Geelvinks.—Dr. Frombeck communicated a memoir On an extension of the doctrine of sphere functions and the forms of development, from these, of a function in infinite series.

PARIS

Academy of Sciences, Aug. 3.—M. Bertrand in the chair.—The following papers were communicated:—Double series of drawings representing terrestrial cyclones and solar spots, executed by M. Faye. The drawings are to be published in the Mémoires; the present communication contains a detailed description of them.—Eighth note on guano, by M. E. Chevreul. The author has detected the following salts in guano:—Ammonium carbonate and chloride, calcium urate, phosphate, and oxalate; certain potassium salts of volatile organic acids. The following double salts have been recognised:—Potassium ammonium oxalate, potassium ammonium sulphate, sodium ammonium phosphate, and magnesium ammonium phosphate.—Note on a meteorite which fell on May 20, 1874, in Turkey, at Virba, near Vidin, by M. Daubrée. The fall was accompanied by a loud noise, and the mass, weighing 3·6 kilogrs., penetrated 1 metre into the soil. Analysis showed that the meteorite contained nickel-iron, chrome-iron, ferric sulphide, and an insoluble residue, probably containing enstatite.—Additional note on the fall of meteorites which took place on July 23, 1872, in the district of Saint-Amand (Loir-et-Cher), by M. Daubrée. By an attentive examination of the surface of the soil, four other meteorites weighing respectively 3, 0·3, 0·6, and 0·6 kilogrs. have been discovered.—Blast of sirocco experienced in Algiers on June 20, 1874, and followed over a great part of Algeria, by M. Ch. Sainte-Claire Deville.—Observations made during the last days of the appearance of Coggia's comet; a letter from P. A. Secchi to the perpetual secretary. The author obtained undoubted evidence of polarisation. The linear spectrum of the nucleus apparently continuous was resolved by careful examination into a banded spectrum, the interruptions of which were most apparent near the bands of the second spectrum superposed upon the continuous spectrum of the nucleus. A drawing of the spectrum accompanied the letter.—Indication of a method of establishing the properties of the ether, by M. X. Kretz.—Reply to a former note by M. Houyvet on the scheme for re-establishing a central sea in Algeria, by M. E. Roudaire. The author does not fear that the evaporation would dry up the proposed sea into a salt lake as suggested by M. Houyvet; he is of opinion that such a circumstance would be entirely prevented by the establishment of an inferior counter current.—Memoir on the thermal effects of magnetism, by M. A. Cazin. The author has determined approximately the magnetic equivalent of a *calorie*.—Researches on explosive bodies; explosion of powder; by MM. Noble and F. A. Abel: continuation of first memoir.—Fourth note on the electric conductivity of ligneous bodies, by M. T. du Moncel.—On the passivity of iron, by M. P. de Reynon. The author attempts to explain this phenomenon by a voltaic action transferring oxygen to the iron, and thus polarising the surface of this metal.—On some bismuth and tungsten minerals from the Meymac mine (Corrèze), by M. Ad. Carnot.—Observations on the development of the peripheral nerves of the larvæ of Batrachians and Salamanders, primary and secondary fibres, M. Ch. Roget.—Reproduction by photography of different crystallisations such as are seen under the microscope, by M. J. Girard.—Note on the stratification of the tail of Coggia's comet, by M. A. Barthélemy.—On isoterebenthene from a physical point of view, by M. J. Riban. The author has instituted comparisons between the physical properties of this substance, terebene, and terebenthene.—Constitution of ordinary brominated propylene, by M. E. Reboul.—Action of nitric acid on paraffin; different products obtained; by M. A. G. Pouchet. Among other substances, *paraffinic acid* ($C_{26}H_{26}NO_{10}$) is obtained, which the author has examined in some detail.—On the action of chloral on the blood, by MM. V. Feltz and E. Ritter.—Observations on the hailstones which fell at Toulouse during the storm of July 28, 1874, by M. N. Joly.—Reply to M. Leymerie on the subject of the carboniferous limestone of the Pyrenees and the St. Béat marbles, by M. F. Garrigou.—Observations of a bolide at Versailles on the evening of July 27, by M. Martin de Brettes.—Observation of a bolide at Toulon on July 27, by M. Lecourgeon.

CONTENTS

4

a
r
d
e
d
e
e
s-
n
er
ve
on
I.
ys
to
ce
ly
ed
ar
n-
m
ng
er
al
ear
alt
a
of
of
p-
on
F.
the
el.
nor
ion
ace
om
ons
e of
res,
ent
by
of
ene
has
this
rdi-
tric
G.
O_{10})
-On
E.
ouse
y to
the
Ob-
, by
n on

PAGE
279
281
283
283
284
285
285
286
286
286
286
287
287
290
290
293
295
296
297